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SD71-189

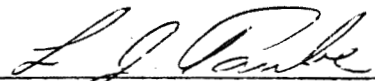
B-70 AIRCRAFT STUDY  
PHASE I REPORT

SEPTEMBER 24, 1971

(NASA-CR-151350) B-70 AIRCRAFT STUDY.  
PHASE I REPORT (North American Rockwell  
Corp.) 106 p

N77-78287

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L. J. Taube  
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B-70 Aircraft Study



Space Division  
North American Rockwell

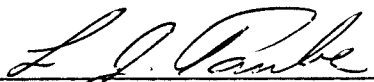


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## INTRODUCTION

The NASA is currently establishing a Data Bank to be utilized in the planning and evaluating of future space programs. This bank will contain cost, schedule and technical information on past and present aircraft and space projects. North American Rockwell has been requested to support the development of this Data Bank by conducting detail studies of selected aircraft and space hardware programs for which the corporation was prime contractor. Realizing the necessity and importance for an information center of this type, NR has committed its resources to support the NASA in their development of this Data Bank.

Recently the Space Division of North American Rockwell completed two studies in our effort to support the development of this Bank. The Apollo CSM and Saturn S-II studies provide the NASA with a comprehensive history of the cost, schedule and technical aspects of these programs. Both studies are structured to the same basic format allowing for integration, comparison and analysis of the data. Utilizing the experience gained from these studies, the Space Division is under contract to perform a similar study of the B-70 aircraft.

North American Rockwell received contractual go-ahead on NAS9-12100, B-70 Aircraft Study, on July 15, 1971. The contract will be conducted in two phases. The initial phase of the study is concluded with the submittal of this report in accordance with the contractual requirements.

Primary effort during Phase I has been directed toward defining the study objectives, constructing a Work Breakdown Structure, conducting a data search to ascertain the quantity and quality of B-70 data available, and developing the Phase II Study Plan. No B-70 data has been prepared or submitted as a part of this Phase I report.

This Phase I report is the Phase II Study Plan. This document outlines the procedures and methods for accumulating and reporting the study data. It provides the proposed Work Breakdown Structure, forms and formats to be utilized during Phase II. A Phase II Statement of Work has been included. The contents of this document should be reviewed carefully to ensure complete understanding of the structure and content of the Study End Items prior to commencing Phase II activities.

In accordance with the contractual requirements, Phase II will not begin until the study plan has been reviewed and approved by the NASA. Phase II completion date of April 14, 1972, is predicated on the NASA review and Phase II go-ahead within one week after submittal of this report.



## BACKGROUND AND SCOPE

The Air Force established a requirement for a Mach 3 advanced strategic bomber to replace the B-52 in early 1954. This program was designated as Weapon System 110-A. The Air Force, NASA and several Air Frame Contractors had performed conceptual studies of this weapon system for several years prior to the publication of the requirements.

In July 1955, the Air Force requested competitive bids for Weapon System 110-A. Study contracts were awarded in November of 1955 to North American Aviation and Boeing Airplane Company for design of the Weapon System and to IBM for the Bombing/Navigation System.

The Air Force selected NAA as Weapon System Manager in January 1958 and work began on Phase I of the Weapon System development. This effort included development engineering and testing, performance specification development, and selection of major subcontractors. WS 110-A was redesignated as B-70 Weapon System in April 1958.

By December 1959, basic solutions to major technical problems had been resolved and engineering drawings were being prepared. Development was well advanced and considerable development hardware was in existence. In December 1959, the B-70 program was redirected to a single air vehicle (XB-70) and minimum effort airworthiness test program. The IBM B/N system was transferred to another Air Force Contract. Subcontracted airframe work at Boeing, Lockheed and Chance-Vought was terminated.

On September 19, 1960, North American Aviation was advised to proceed with the design, development, fabrication and test of one XB-70 prototype and 11 YB-70 aircraft. This would include development of all major systems needed for an operational Mach 3 bomber.

Six months later the program was redirected again to a prototype development program consisting of three aircraft. The major objectives of this program were to design, fabricate, and demonstrate the technical feasibility of a high altitude, long range, Mach 3 type vehicle and to demonstrate the operation of an integrated prototype bombing navigation system. Air Vehicle Number 3 was cancelled in March of 1964 and with it went the objective to demonstrate the operation of an integrated bombing navigation system.

The first air vehicle was rolled out on May 11, 1964. First flight occurred on September 21 and by October 24 four flights totaling 5 hours and 2 minutes had been accomplished and Mach 1.42 had been reached. The second XB-70 was rolled out on May 29, 1965 and flew on July 17 reaching Mach 1.4 and 40,000 feet. Air Vehicle number 2 completed the demonstration of the program objectives on May 19, 1966 when it flew in excess of Mach 3 for 33 minutes.

The flight test phase to demonstrate the program objectives ended in late July 1966. At this point NAA entered into two contracts with the Air Force and NASA to use Air Vehicle Number 1 as a test bed. Under these contracts NAA maintained the aircraft and provided modifications as required for the conduct of these test programs. These tests were concluded in February of 1969.

A chart (Exhibit 1 ) is included to present graphically the phasing of the B-70 program. Contracts, significant development progression points and the air vehicle production and flight test spans are shown. Collection and reporting of cost, schedule and technical data in support of this study will encompass the period from January 1958 through July 1966. Data generated prior to 1958 was in support of the early concept and design studies. The Air Force did not select the prime weapon system contractor (NAA) until December 23, 1957. Study data will begin with the award of this contract. The program objective to demonstrate the feasibility of sustained Mach 3 flight was achieved in May 1966 with the flight test phase of the program ending in July of that year. Study scope will include all data through this point. A discussion of technical and cost data at a summary level will be included in the Final Report for the contracts prior to 1958 and the Flight Test contracts after 1966.

1954				1955				1956				1957				1958				1959				1960			
1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4

CONCEPTUAL STUDY CONTRACTS

AF33(600)-36599

AF33(600)-3

DEI (WS CONFIG)

RS-70

XB CONFIG (REDI  
TO SINGLE PROTC

62

1

12

START DE

NO. 1

1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
1954				1955				1956				1957				1958				1959				1960			

1960				1961				1962				1963				1964				1965				1966			
2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1

(600)-38669  
 AF33(600)-42058  
 AF33(657)-12395

AIR FLIGHT  
 XB CONFIG AT ROLLOUT  
 XB CONFIG AT SUSTAINED MACH 3

XB CONFIG DEI (INCL 5° WING CHG)  
 XB CONFIG (REDIRECTED ANGLE PROTO)

12 3 2

START DETAIL FAB  
 ROLLOUT  
 1ST FLT  
 1ST MACH 3 FLT  
 NO. 2  
 ROLLOUT  
 1ST FLT  
 SUSTAINED  
 DESTROYED  
 NO. 3  
 TERMINATED

2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1
1960				1961				1962				1963				1964				1965				1966			

AF33(657)-12395

AIR  
FLIGHT

FIG (REDIRECTED  
GLE PROTO)

XB CONFIG DEI  
(INCL 5° WING CHG)

XB CONFIG AT ROLLOUT

XB CONFIG A1  
SUSTAINED 114

- START DETAIL FAB

- ROLLOUT

1ST FLT

1ST MACH  
3 FLT

NO. 2

- ROLLOUT

- 1ST FLT

SUSTAINED

• DESTROYED

TERMINATED

NO. 3

960

1961

1962

1963

1964

1965

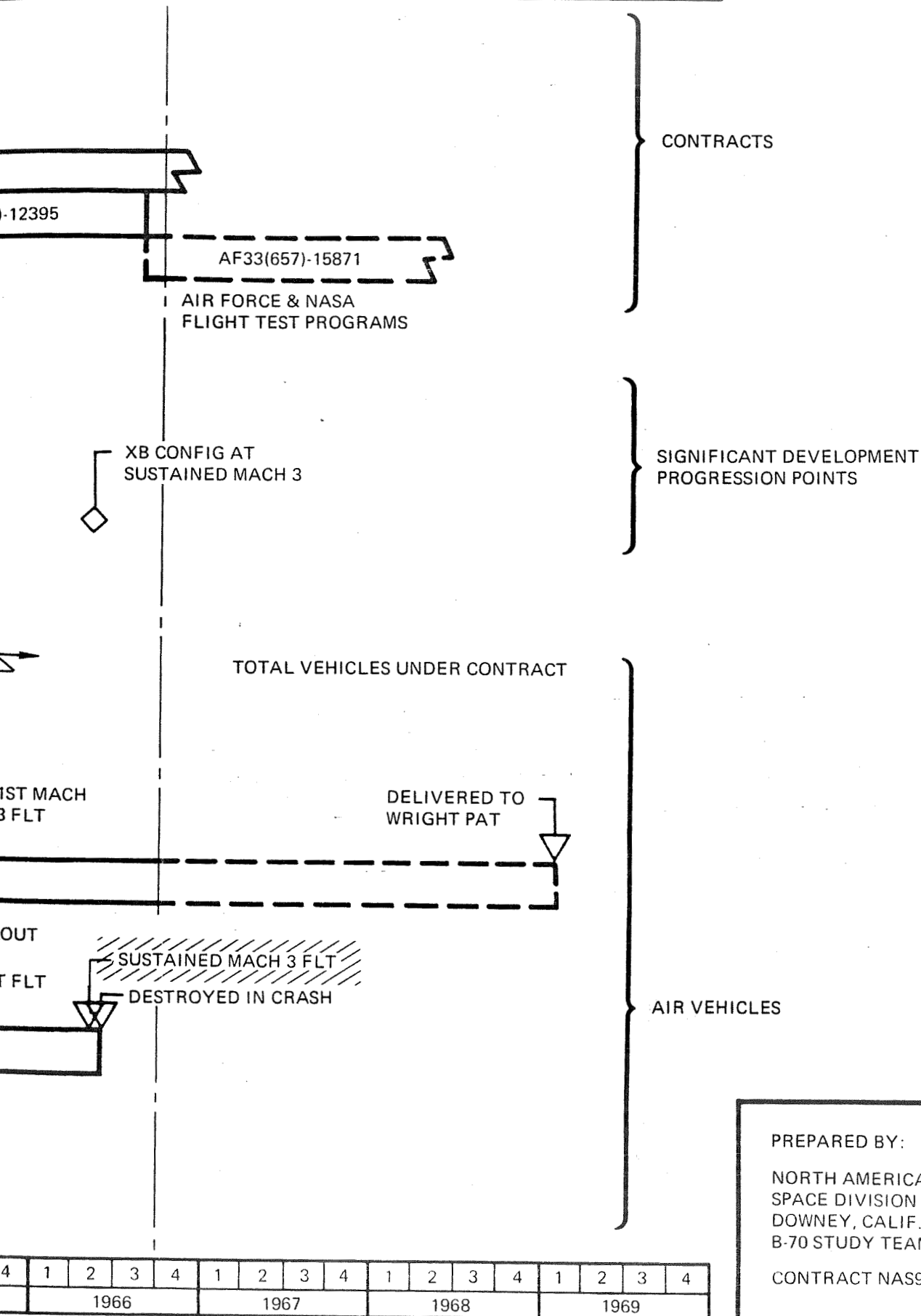
1966

## STUDY TIME FRAME

4a



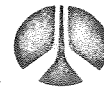
1966					1967					1968					1969				
4	1	2	3	4	1	2	3	4		1	2	3	4		1	2	3	4	



PREPARED BY:

NORTH AMERICAN ROCKWELL  
SPACE DIVISION  
DOWNEY, CALIF.  
B-70 STUDY TEAM

CONTRACT NAS9-12100 9-24-71



## SECTION I

### WORK BREAKDOWN STRUCTURE

The development of a Work Breakdown Structure (WBS) was a prime objective of Phase I. The WBS had to be designed to accommodate cost, schedule and technical data for the B-70 subsystems and provide a logical grouping of program elements not related to the subsystems. The proposed WBS is displayed in Exhibit 2 page 6.

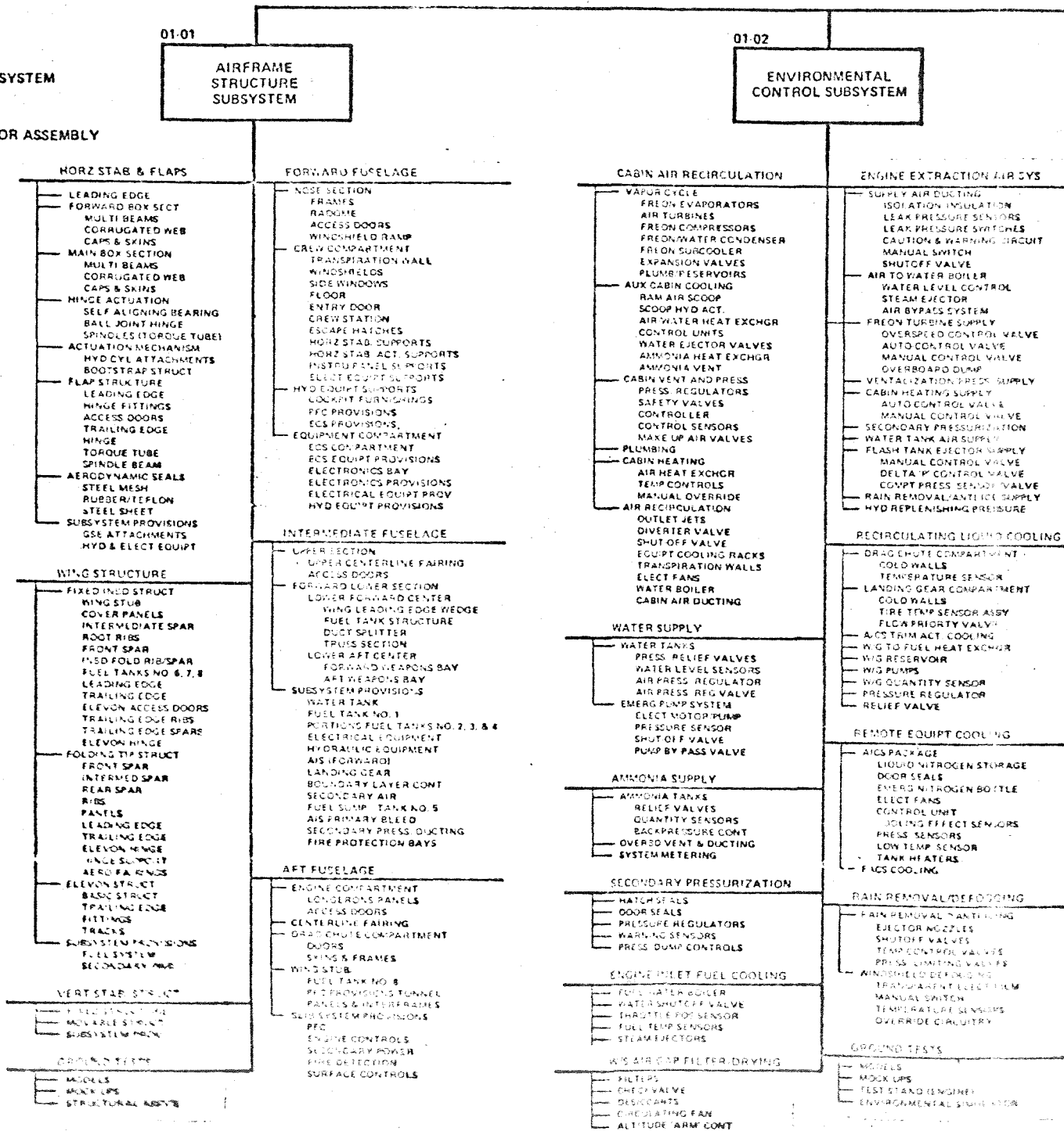
Subsystems of the B-70 aircraft are gathered and displayed under the WBS block titled "Air Vehicle". To retain consistency with other Work Breakdown Structures developed for similar NASA studies, the subsystems are displayed at level 5. Major assemblies, minor assemblies, components and piece parts contained within these subsystems are displayed as indentures indicating WBS level 6 and below.

Program elements not associated with the subsystems have been logically grouped on the same level as "Air Vehicle" (level 4). Definition of the data at level 5 and below has been influenced, to a great extent, by the availability and identification of the cost data. Exhibit 3 page 7 provides a definition of all level 4 blocks. Level 5 through level 9 definitions will be provided in the Study Final Report.

The construction of the WBS has been a combined effort of cost, technical and schedule personnel assigned to the study. The subsystems reflect the configuration of the vehicle that achieved the program objective of sustained Mach 3.0 flight. B-70 configuration specification, system briefings and special system reports were reviewed to accumulate the subsystem, assembly, component and piece part detail. Engineering, manufacturing and accounting records were researched to define non-hardware system elements.

To assist in the accumulation and reporting of the study data, a WBS coding system has been developed. The numbers appearing on the WBS in Exhibit 2 page 6 represent the codes assigned at levels 4 and 5. The first two digits reflect level 4 with subsequent digits reflecting levels 5 through level 9. A detail list of codes for WBS level 6 through 9 items will be supplied with the Final Report.

Cost, schedule and technical data will not be presented for all items of the WBS. Schedule and technical data will be provided for those items having a significant impact on the schedule or technical development of the B-70 program. Cost data will be presented at various levels as determined by departmental and accounting records. Consult the cost, schedule and technical sections of this report for a detailed discussion of the selected WBS items to be included in the Study Final Report.



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## PROPULSION SUBSYSTEM

SECONDARY  
POWER  
SUBSYSTEM

## FUEL SYSTEM

7-5 ENTER SUPPLY SYS

## EFFECT POWER SUPPLY SYS

- PRESS. REFUELING/DEFUELING
- DRAIN SAMPLE VALVES
- SPRAY NOZZLES
- SHUTOFF VALVES
- REFUELING PANEL
- LCV CONTROL SWITCHES
- ELECT. RECEPTACLE
- STATIC GROUND
- TEST SWITCH
- LCV TEST CIRCUIT
- MANAGEMENT QUANT. INDICATION
- DIGITAL GAGES
- ROTATORY SELECTOR SWITCH
- DISPLAY PANEL
- PUMP CONTROL PANEL
- PUMP CONTROL SWITCHES
- TEST SWITCHES
- PANEL TAPES
- CAUTION & WARNING
- FUEL PROBES
- FUEL CONTROL UNIT
- ANTILOG. DRIVER ASSY
- SEQUENCE SWITCHES
- PANEL MOTOR
- MANUAL OVERRIDE CIRCUIT
- FUEL TRANSFER
- DUAL LEVEL CONT. VALVES/ILCV
- FUEL PUMPS
- CHECK VALVES
- FILTRATION
- FILTER ELEMENTS
- HOUSING SEALS
- ENGINE FUEL SUPPLY
- BOOSTER PUMPS
- CHECK VALVES
- ENGINE SHUTOFF VALVE
- THE BY-PASS
- COOLING LINE

## ENGINE INSTALLATION

- ENGINE SHROUD & SEALS
- AIR DUCTS & SEALS
- NOSE FAIRING
- FIRE DETECTOR RINGS
- MOUNT ASSYS
- PTO COUPLING
- DRAIN & VENT LINES
- N<sub>2</sub> SUPPLY LINES
- COMPRESSOR BLEED AIR
- SERVICING PROVISIONS

ENG COMPART COOLING

- B/F FALS PLenum VALVES
- BLB D VERTER VALVES
- ACTUATION MECH
- BELLOWS PRESS SWITCH
- GLB CHECK VALVES
- A/B OVERRIDE VALVES
- FIRE OVERRIDE CONT
- SERVO VALVES
- FILTERS
- GROUND COOLING DOORS
- CONTROL SWITCHES
- FIRE WALL HEAT SHIELDS

# GASEOUS NITROGEN SYS

- AIR/FUEL TANKS
- PRESS. REGULATOR
- SENSORS
- RELIEF VALVES
- ENGINE SUPPLY REG.
- ADS SUPPLY REGULATOR
- FLOW LIMIT SHUTOFF
- FILL VALVE
- CHECK VALVES

- AIR FLOW GENERATION
  - PUMPS
  - FILTERS
  - MAIN GUIDES
  - SUPPLE DAMPERS
  - CHECK VALVES
  - BYPASS VALVES
  - REVERSE VALVES
- PRESSURE SYSTEMS
  - AIR FLOWERS
  - OUT-LET AIRCHANGERS
  - AIR-TO-AIR COILS
  - AIR-TO-WATER VALVE
  - HOT WATER PRESS. SUPPLY
  - W/OUT PERCENT SHUTTING
  - COOLING & HOT SERVICE
- AIR DISTRIBUTION SYS
  - MANIFOLDS, LINES
  - FILTERS
  - RING FOLD SUPPLY
  - MAIN DEAR SUPPLY
  - W/OUT DEAR SUPPLY
  - AIR VARY FLT CONT
  - SECONDARY FLT CONT
  - FLT AUG CONT SYSTEM
  - AIR-1 SYSTEM SUPPLY
  - AIR-2 FOLD RAMP
  - EMERGENCY SUPPLY
  - AIR SUPPLY
  - AIR-2 FOLD TESTS
- CENTRAL AND DISPLAYS
  - ANIMATOR PANEL
  - PRE-SET PAGES
  - PRESSURE SENSORS
  - DUAL TRANSMITTERS
  - SYSTEM MANUAL SELECT

122202 • DRIVE SYS

[illegible]

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2-12-68 11:40 AM  
 2-12-68 11:40 AM  
 2-12-68 11:40 AM

\*\*\*\*\* FIVE (CSD)

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- POWER GENERATION
  - PRIMARY GENERATORS
  - EMERGENCY GENERATOR
  - VOLTAGE REGULATORS
  - LINE TRANSFORMERS
  - LINE CONTACTORS
  - BATTERY
  - GENERATOR CONTROLS
    - OVERVOLTAGE
    - UNDERVOLTAGE
    - OVEREXCITATION
    - UNDEREXCITATION
    - OPEN PHASE
    - UNBALANCE
    - FEEDER FAULT
- EXTERNAL POWER SUPPLY
  - INTERLOCK CONTROL
  - RECEPTACLE
  - INTERCONNECT CONTROL
- POWER TRANSMISSION & DISTRIBUTION
  - FEEDER LINES
  - PRIMARY BUSES
  - ESSENTIAL BUS
  - DC BUS
  - TRANSFORMER-RECTIFIER
  - RELAYS
  - BUS TIE CONTACTORS
  - CONNECTORS WARES
  - YAW TRIM MOTOR
  - AIS TRIM MOTORS
  - THRUST CONT. SUPPLY
  - STABILIZER TRIM MOTOR
  - PITCH TRIM MOTOR
  - ROLL TRIM MOTOR
  - LANDING LIGHT ACTUATORS
  - INSTR. PANEL V. B. MOTOR
  - BOMB BAY DOOR LOCKS
  - CIRCUIT BREAKER PANEL
  - CREW COMPLAINT SUPPLY
  - COCKPIT FLOOD LIGHTS
  - COCKPIT UTILITY LIGHTS
  - ANTI COLLISION LIGHTS
  - NAVIGATION LIGHTS
  - LANDING LIGHTS
  - EMERG. GEAR LOWERING
  - AUXILIARY LIGHTS
  - SWITCHES
  - TRANSFORMERS
  - WING TIP FOLD CONTROL
  - LANDING GEAR CONTROL
  - DROG CHUTE CONTROL
  - CONTROLS & DISPLAYS
    - BUS INDICATION PANEL
    - VOLTAGE INDICATOR
    - BUS SELECTION SWITCH
    - AUTO RECYCLE CONTROL
    - PHASE SELECTION SWITCH
    - MANUAL ON/OFF RECYCLE SW

## GROUND TESTS

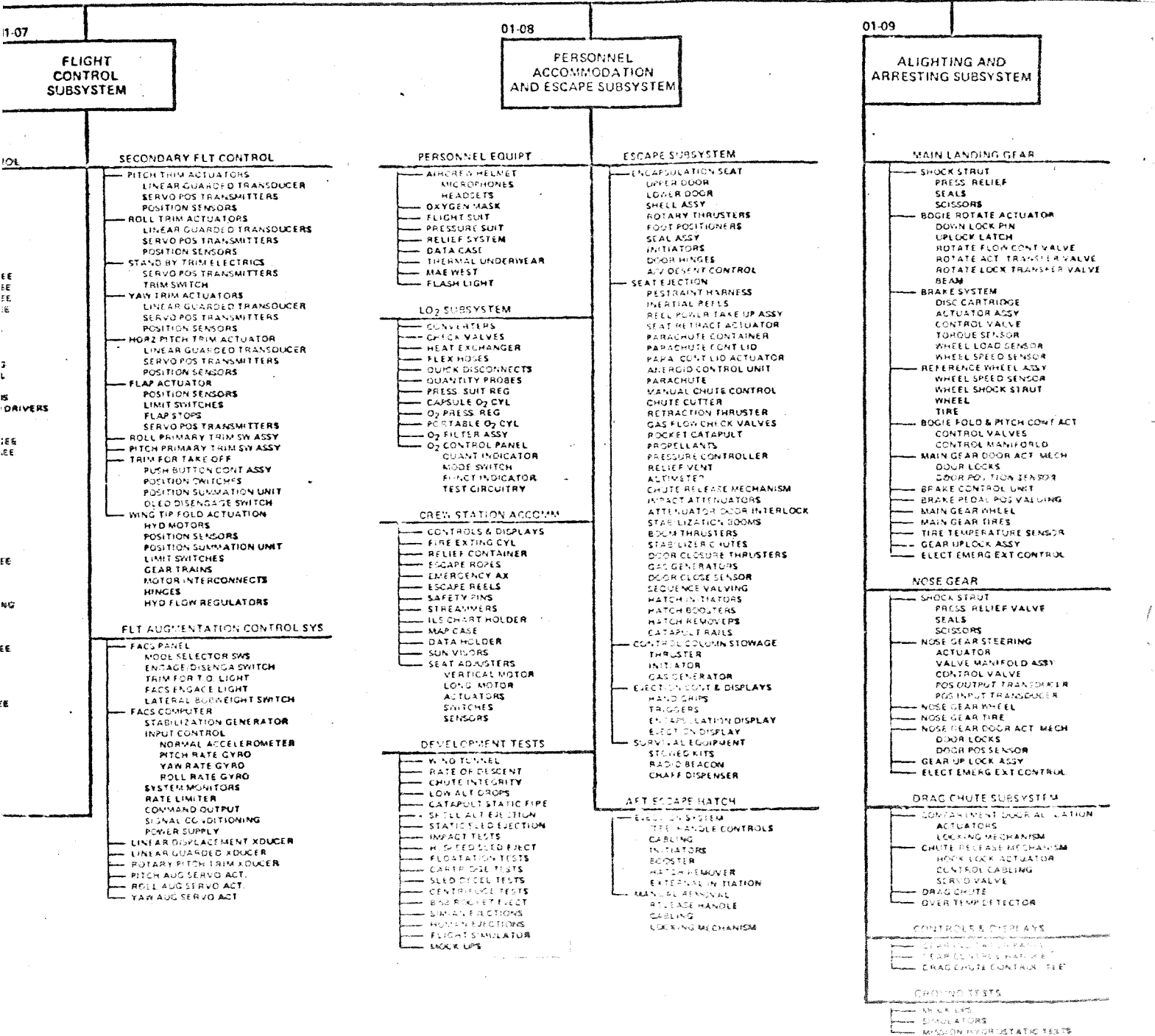
ENGINE TEST STAND  
FLIGHT CONTROL SIMULATOR  
HYD LAB  
ELECTRICAL LABS  
MODELS  
MOCK UPS

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ba

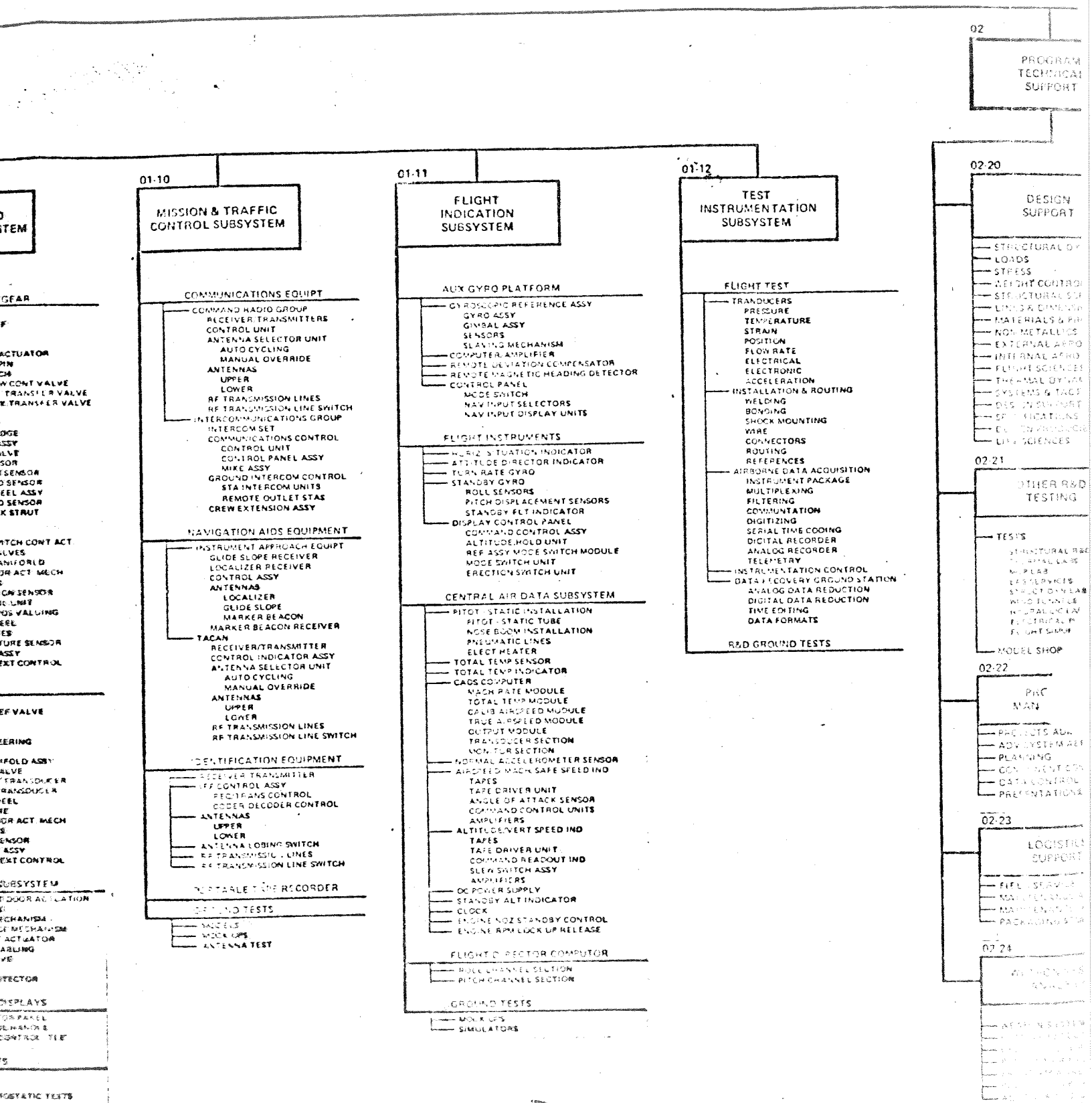


B70  
PROGRAM



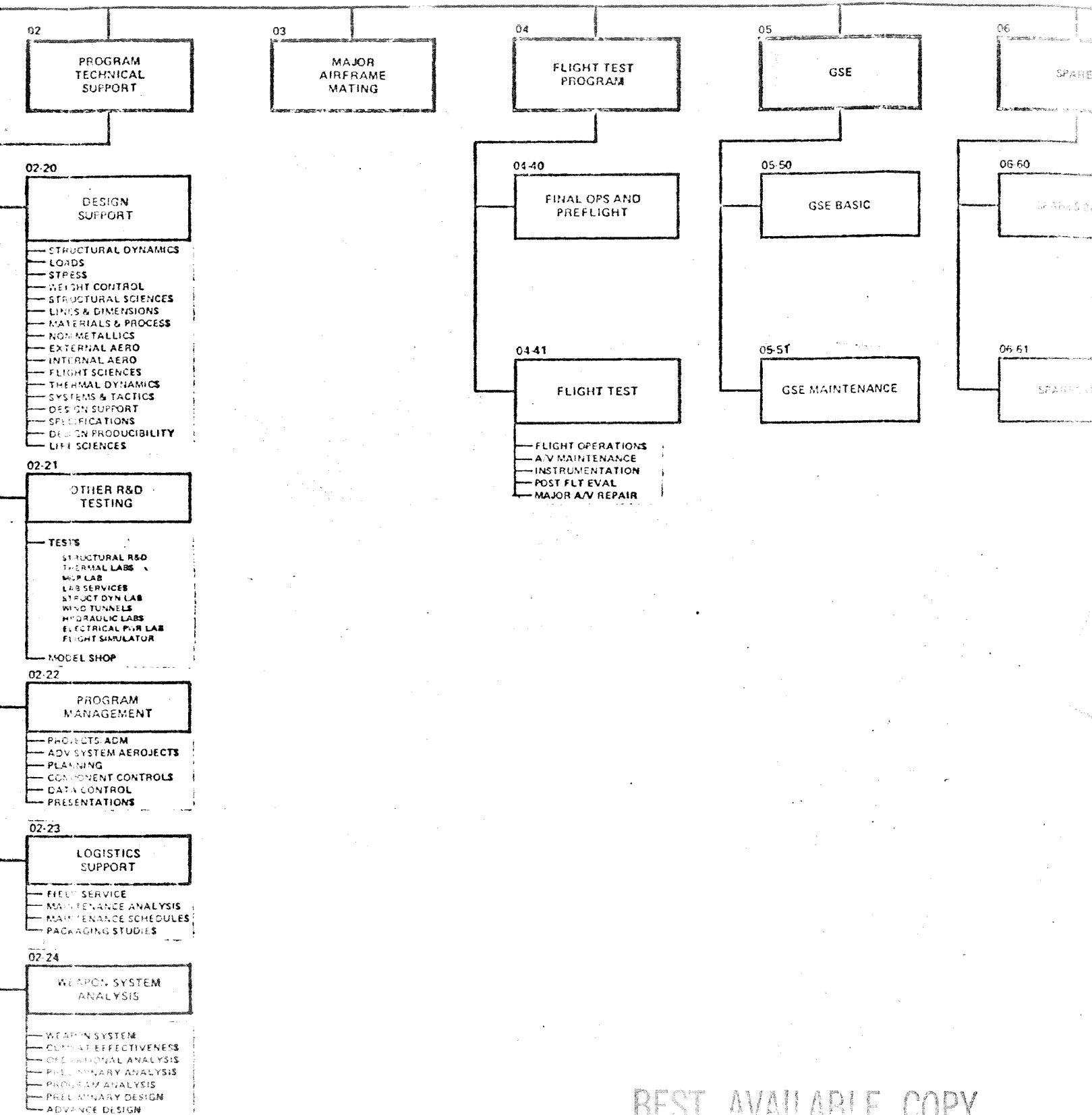
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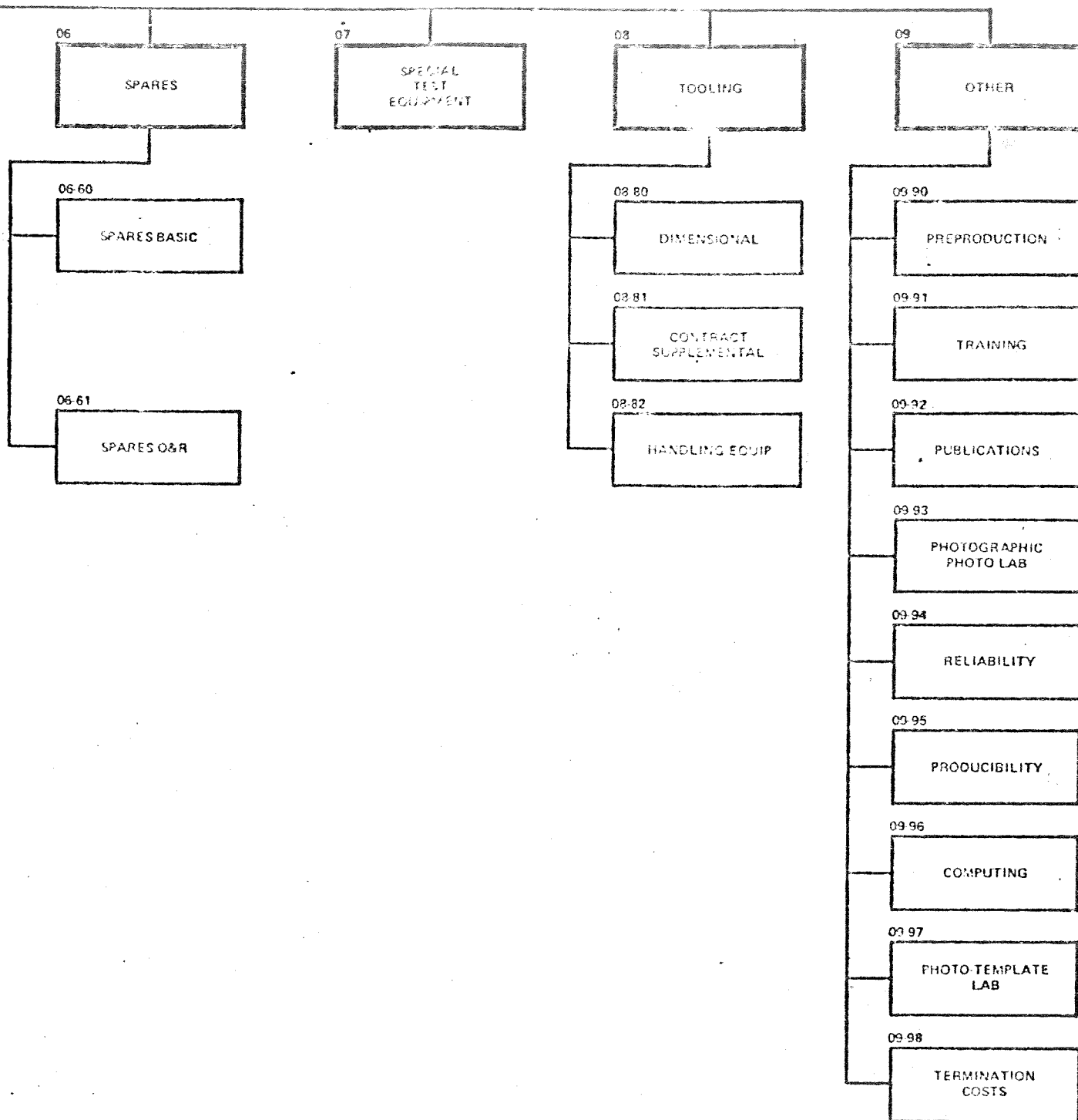
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6 e





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Exhibit 2

6 F

B 70 WBS - 9-24-71

NASA CONTRACT NAS342100

PREPARED BY:

NORTH AMERICAN ROCKWELL  
SPACE DIVISION  
DOWNEY, CALIFORNIA  
B 70 STUDY TEAM

B 70 WORK BREAKDOWN STRUCTURE

WORK BREAKDOWN STRUCTURE  
LEVEL 4 - PROGRAM ELEMENTS  
DEFINITIONS

01 - Air Vehicle

Effort included in this WBS item is directly associated with the design, development, manufacture, procurement and testing of the vehicle subsystems. Design and development includes developmental testing and other activities directly related to the subsystems and not the R&D testing activity to determine external configuration, characteristics and requirements. Excluded also is the program technical support effort i.e. aerodynamics, thermodynamics, structural dynamics, weights, loads, stress, etc. See 02 - Program Technical Support.

Manufacturing includes all production, assembly and subsystem installation effort, (including engine build-up) to produce the B-70 aircraft. It excludes major airframe mating, tooling and pre-flight operations. Included will be modifications and rework as the result of the flight test program but exclude major air vehicle repair due to accidents.

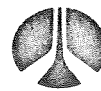
Procurement includes subcontractor effort for the major purchased subsystems, assemblies and components. All costs associated to a particular subcontractor will be included under this WBS block.

02 - Program Technical Support

This WBS item will accumulate all effort associated with the technical aspects of the program which cannot, without allocation, be associated to a subsystem. Included will be design support, R&D testing, wind tunnel, model shop, program management, logistics support and weapon system analysis.

03 - Major Airframe Mating

Data accumulated in this WBS item will be the manufacturing and supporting activities necessary to assemble the major sections of the airframe. This activity presented difficult and unique problems; therefore, special emphasis and increased visibility is provided by establishing a separate WBS item. Assembly activities include welding center sections, premate check and mating of the upper intermediate fuselage, welding forward and aft outboard fuselage sections, mating forward fuselage and wings, and installing main nose gear and vertical & horizontal stabilizers.



04 - Flight Test Program

All engineering, manufacturing and testing activity excluding system development activities, design changes or equipment modifications will be included in this WBS item. The flight test program will include final operations, pre-flight activities and all flight test oriented activities up to achievement of the program objective of sustained Mach 3.0 flight. Included in this WBS item are flight operations, air vehicle maintenance, instrumentation effort after first flight, post flight evaluation and major air vehicle repair as the result of malfunctions or accidents.

05 - Ground Support Equipment

This WBS element covers the effort to design, develop, manufacture or procure factory and flight test Ground Support Equipment. Data will be segregated between basic effort and maintenance. GSE produced or procured for the exclusive use of a subcontractor is excluded.

06 - Spares

This WBS element includes the tasks required to plan, fabricate or procure spare parts required to support the vehicles, GSE, STE and training equipment. It excludes those articles fabricated for ship # 3 but utilized as spare parts when ship #3 was cancelled.

07 - Special Test Equipment

Included in this WBS item are the tasks required to design, fabricate and/or procure special test equipment utilized by Engineering, Manufacturing, Quality Control and Plant Engineering. Data will be segregated between basic effort and maintenance.

Manufacturing STE is that equipment and those devices used to test the operation of end products during and after the manufacturing process. Included are such items as continuity checkers, analyzers, electronic consoles, hydraulic test units, pressure test units and similar portable equipment which do not become end products or part of the end products.

Plant Engineering STE includes the design and fabrication of equipment such as hydraulic test units, engine run-up test stands, etc.

08 - Tooling

This element contains those tasks required to design, fabricate and/or procure dimensional tooling, contract supplemental tooling and material handling equipment. It excludes tooling effort by a subcontractor for his use in providing the subcontracted equipment.



Contract supplemental tooling includes those special or single purpose machines and devices intended to include jet engine starters and related gear boxes, sound abatement devices and any other major item as contemplated by the contract.

Material handling equipment includes dollies, slings, pickup stands and platforms and similar structures built in or around jigs or airplanes, the purpose of which is to support the worker and render more accessible the assemblies or parts being worked.

09 - Other

This element includes all other activities and tasks not associated with any other elements of the WBS. It includes such items as pre-production, training, publications, reliability, producibility, and termination costs.



## SECTION II

### COST DATA

The primary objective of the Final Report cost data will be to provide the report user with a time-phased history of the North American Rockwell/Los Angeles Division recorded costs on the B-70 aircraft program. In support of this Study objective, Phase I cost objectives have been to (1) identify the study time frame and establish reporting periods, (2) establish the Subdivisions of Work and Elements of Cost utilizing NASA document MF002M as a guide, (3) review in-house cost records to determine their availability and applicability to support the overall study objective, (4) develop procedures and methods for the accumulating and reporting of the cost data, and (5) prepare a Phase II Study Plan.

The following section of this report will discuss each objective and outline our activities, problems and recommendations. This report presents the plan for accumulating and reporting the cost data during Phase II. Therefore, no cost data is included in this report.

#### A. Study Time Frame and Scope

Selection of North American Aviation's Los Angeles Division as Weapon Systems Manager for WS 110-A on December 23, 1957 will be the beginning of the cost data presented in the Final Report. Costs for preliminary design effort occurring prior to this point will not be included in the detailed cost data. Discussion of this pre-contract award period will be provided at a summary level.

Detailed study cost data will capture all costs from December 23, 1957 until the program objective of sustained Mach 3.0 flight was reached in May 1966. In August of 1966, the remaining B-70 aircraft was released to the Air Force to be used as a test bed. North American Aviation participated in these test programs by maintaining the aircraft and providing modifications as required. The costs from August 1966 through completion of the Air Force test programs in February 1969 will not be included in the detailed cost data. This effort will be discussed and cost data provided at a summary level only.

Four contracts were active during the period from December 23, 1957 through July 1966. Costs accumulated against these contracts will form the basis for all detail cost data presented in the Final Report. These contracts are:

AF33(600)-36599

AF33(600)-38669

AF33(600)-42058

AF33(657)-12395



During the conduct of these contracts many major program redirections were experienced. Schedule and technical report data will discuss these redirections. No attempt will be made to establish cost impacts of these major redirections during Phase II of this study.

Phase II cost data will be accumulated on six month centers starting with March 1958 and culminating in September 1966. Time Phasing of the cost data will enable analysis and correlation of this data to the schedule and technical information contained in the Final Report. March and September were selected as September is the end of NR's fiscal year and March represents the fiscal year mid-point.

All time-phased cost data will be supplied at the conclusion of Phase II in rate input form. Input data for each six month period will be provided. No cumulative figures will be available except at the program summary level.

B. Subdivisions of Work

The subdivisions of work (SDW) to be utilized to segregate cost data into major areas are:

- Design/Engineering
- Manufacturing
- Tooling/STE
- Test/Quality Control
- Other

Definitions of these SDW's are as contained in NASA document MF002M and are not presented here. The Final Report will include the SDW definitions as slight modifications may occur as the result of Phase II cost activities. Every item of the Work Breakdown Structure where cost data is available will use these SDW's to provide further definition. Summary data by Subdivision of Work will be provided at the program level in the Final Report.

C. Elements of Cost

Exhibit 4, page 16 provides a list of the Elements of Cost (EOC) to be used to display the cost data. Each block of the WBS and every SDW will have costs collected utilizing these elements. A summary of the B-70 costs at the program level by the Element of Cost will be provided in the Final Report. Definitions of each EOC will also be included in the Final Report.

Codes have been assigned to each Element of Cost. These codes will be used to gather and display the cost data. The codes are compatible with the NR Space Division Pricing System which will be used to organize and print out the Final Report Cost Data.



#### D. Accounting Records Background

To provide a basis upon which time-phased cost data could be derived for the four Air Force contracts included in this study, a review of the Los Angeles Division accounting records was initiated. This review resulted in the identification of the "514 Cost Accumulation Statement" as the financial document providing the most detailed and comprehensive accumulation of cost data. The 514 tab is comparable to the Space Division 542 Cost Accumulation Statement utilized to provide the Apollo CSM Study Data. These tabs for the appropriate time periods were collected and reviewed for continuity and consistency of data.

Four levels of data are available from the 514 tabs. They are (1) Contract, (2) General Order, Sales Order or Order, (3) Subaccount and (4) Ledger Account. All cost data are accumulated and reported using these levels.

Contractual effort performed at the Los Angeles Division is assigned a number by the contracting agency. Internally, general orders, sales orders and orders are issued against the contract to gather and report cost data. The number of general orders, sales orders and orders issued against a contract usually depends on the scope, size and reporting detail required by the contract. Generally, one order is issued for each contract to accumulate the basic charges. General orders and sales orders are opened to accumulate supporting effort, additions and termination charges.

The 514 tab is organized by order, general order and sales order number. Recorded cost data is cumulative from date of inception. Items are not eliminated from the tab as they are closed. This is a significant point as the B-70 program experienced many redirections resulting in four contracts and 41 orders, general orders and sales orders.

The next level of data beneath the orders, general orders and sales orders contains the subaccounts (S/A). They represent tasks to be performed within the scope of the order they support. Subaccounts are under the direct control of the functional organizations within the Los Angeles Division. Prior to establishing a new subaccount the functional organization responsible for that S/A must receive approval from the Program Office, Contracts and Pricing and Financial.

The lowest level of detail available from the accounting system is the ledger account (L/A). Financial maintains control over the issuance and closure of all ledger accounts. The Chart of Accounts, prepared and maintained by Financial, provides a description of each L/A in use at the Los Angeles Division. The Chart of Accounts is not included in this report.

Ledger accounts are the building blocks upon which the entire accounting system is constructed. All direct and indirect costs are assigned to them. Ledger accounts are grouped into the following major categories.

- 30XX - Rework and Replacement
- 32XX - Contract Flight
- 33XX - Packing and Shipping
- 34XX - Fabrication and Assembly
- 35XX - Tooling
- 36XX - Tool Maintenance and Obsolescence
- 37XX - Engineering and Logistics Support
- 38XX - Engineering Test Reports and Services
- 39XX - Direct Expense

Utilizing the 514 Cost Accumulation Statement and the levels of data available from it, a plan has been developed for the accumulation of the time-phased cost data. This plan is outlined in the following section of this report.

#### E. Methods and Procedures

Providing time-phased cost data within the framework of the WBS, Subdivisions of Work and Elements of Cost is the principle cost objective of Phase II. The following paragraphs provide a discussion of the procedures to be utilized during Phase II to meet the study objectives.

The B-70 orders, general orders and sales orders were assigned to the appropriate WBS items based on an analysis of their Statements of Work. Exhibit 5 provides a cross-reference of orders, general orders and sales orders to their assigned WBS items. 92.7% of the costs, representing 15 orders, could not be assigned to a specific WBS item. These orders primarily pertain to "01-Air Vehicle" and "02-Program Technical Support." As a result of the large amount of costs associated with these orders, further analysis was conducted to establish a method by which costs could be assigned to the WBS.

This analysis investigated the possibility of utilizing the next level within the accounting system, the subaccounts. Subaccount bulletins, issued and approved by Financial at the request of functional departments, were collected and reviewed. Following is a discussion, by functional area, of this analysis and the resulting proposed method for assigning costs to the WBS items.

#### Engineering

Engineering subaccounts were established to accumulate costs for specific development testing activities only. 22.1% of the total engineering recorded costs are associated to these subaccounts. The majority of costs (77.9%) are recorded against subaccount "0000." No creditable method short of applying an allocation technique could be developed from the subaccount data to assist in the distribution of costs over the WBS. Additional research was conducted into the ledger account structure and departmental records.

Ledger accounts in the 38XX series are used by engineering personnel to record their time. Each ledger account in the 38XX series was analyzed



for possible assignment to the WBS. It was discovered that most of these ledger accounts did fit into the WBS; however, some basic problems existed. No ledger accounts could be associated with the "Lighting and Arresting System," "Flight Indication System" and "Program Technical Support." Development testing effort could not be identified from the ledger accounts, and certain effort identified on the WBS, i.e., "hydraulics," could not be obtained. Additional research was conducted to develop the approach to be used during Phase II.

Within the Engineering Planning organization detail records by Engineering group, ledger account and contract were maintained. The engineering groups can be assigned to the WBS, in some cases to level 6 items. Additional detail may be obtained from the ledger accounts which reflect design support to other WBS items. For example, the Air Induction Subsystem (AIS) design group supported Structures and Propulsion design. Ledger account detail for the AIS design group will identify the amount of support that group provided to the other subsystems. The decision to move the AIS support effort to other subsystems or retain the total AIS effort under the AIS subsystem must be made by the NASA and NR.

To take full advantage of the detail the engineering group records provide, each group will be assigned to the WBS and cost data within that group summarized by ledger account. This approach will allow the flexibility of rearranging ledger account detail based on the decision discussed in the previous paragraph.

To assure that the group records reflect the totals reported in the accounting data, the two figures will be summarized and compared. Ledger accounts from the 514 tab have been assigned to the WBS. Exhibit 6 provides a cross-reference of ledger accounts to WBS items. Ledger account totals will be prepared and a comparison made to the group data. Major discrepancies will be identified and resolved. After adjustments are made to the group records, they will be used to provide the study data for the WBS items.

### Manufacturing

Subaccounts on the manufacturing area, which includes Quality Control, are called "releases." Separate release structures were established for each of the three vehicles produced under the program. Vehicle #1 had two releases to collect manufacturing costs: one release for details and the other for assemblies. No additional detail is available from the accounting records for Vehicle #1. Vehicle #2 had one release for details and 13 releases for assemblies. These assembly releases involved structures, equipment installation, mating and final operations. Vehicle #3 followed the same basic release structure as Vehicle #2 with some minor variations. Vehicle #3 was cancelled one year after it was added to the program, so cost figures do not represent a complete vehicle. Considering the different release structures for the vehicles and the lack of WBS detail available from them, a decision was made to investigate other methods of associating manufacturing costs to the Work Breakdown Structure.



Manufacturing, exclusive of Tooling, utilizes the 30XX, 33XX and 34XX series of ledger accounts to accumulate recorded costs. These ledger accounts represent functional areas within Manufacturing, such as Planning, Packing and Shipping, Engineering Support, etc. The ledger accounts are not constructed for assignment to the WBS.

The Manufacturing Cost Analysis group maintained detail records by department. These records provide sufficient data on the fabrication of the major airframe sections, escape capsule, selected subsystems, final joining and subsystem installation. WBS level 6 data can be obtained for selected items. These records provide the greatest visibility of the manufacturing costs and will be used to provide the assignment of manufacturing costs to the WBS.

To ensure that the manufacturing departmental records reflect the totals reported in the accounting data, the two figures will be summarized and compared. Ledger accounts from the 514 tab will be assigned to the WBS with those ledger accounts representing functional areas (Planning, Q.C., etc.) summarized as elements of cost within the WBS. Exhibit 6, page 19 provides a cross-reference of manufacturing ledger accounts to the WBS and EOC's. Major discrepancies between the ledger account totals and department totals will be identified and resolved. After the necessary adjustments are made to the department records, they will be used to provide the manufacturing totals for the WBS items. Planning and quality control support will be prorated based on the manufacturing spread.

#### Tooling and Special Test Equipment

A subaccount structure is not utilized in the tooling and special test equipment area to provide detail. The ledger accounts are not structured to allow the assignment of tooling or STE costs to WBS hardware items. As a result, two level 4 WBS items were created to collect and report those costs, "07-Special Test Equipment" and "08-Tooling."

The ledger accounts do provide sufficient detail to allow costs to be collected in these two items. Exhibit 6, page 19 supplies the assignment of the 35XX and 36XX series of ledger accounts to the proper WBS items. All costs in WBS items "07" and "08" will come directly from the 514 Cost Accumulation Statements.

Tooling costs will be further segregated between dimensional tooling, contract supplemental tooling and material handling equipment. Ledger account detail will provide this segregation. All tooling costs will be displayed beneath the "Tooling and STE" Subdivision of Work.

Special Test Equipment costs will be segregated between engineering, manufacturing and quality control. Ledger accounts provide this level of detail. The Subdivisions of Work will be utilized to display this segregation with engineering STE display in the Design/Engineering SDW, manufacturing STE in the manufacturing SDW and quality control STE in the Test/QC SDW.



### Logistics

Logistics does not utilize a subaccount structure to provide additional cost detail. The ledger accounts in the 37XX series are used by logistics to segregate their cost data. These ledger accounts can be assigned to the WBS. Exhibit 6, page 19 provides the assignment of the ledger accounts to the WBS items. All logistics costs will be collected from the 514 Cost Accumulation Statements.

### Material

Subcontracted effort on the B-70 program can be identified to a specific subcontractor by the subaccount structure. During Phase II the subcontracting cost will be accumulated from the accounting records for each subcontractor utilizing these subaccounts. The subcontractor will be assigned to the WBS, in some cases at level 6, 7, or 8. Subcontractor costs will be further segregated between major supplier and minor supplier (purchased parts).

Subdivision of Work detail for the major subcontractors will be derived from in-house records. These records, nor the procedures to be utilized, have not been identified at this time. Prior to initiating this procedure, the method will be reviewed with the NASA.

Engineering, manufacturing and tooling material can be obtained from the Cost Accumulation Statements. Material not charged to a supplier subaccount will utilize a functional area ledger account. These ledger accounts will be used to collect material costs. Material accumulated in 37XX and 38XX accounts will be classified as engineering material, 30XX, 33XX and 34XX material costs will be classified as manufacturing material, and 35XX and 36XX material costs will be classified as tooling and special test equipment material.

### F. Nonrecurring/Recurring Costs

For the purposes of this study, all costs associated with the B-70 will be classified as nonrecurring. Recurring costs are defined as those costs associated with production articles. The B-70 program did not reach production stage. The two vehicles produced under this program were classified as experimental aircraft. Therefore, all costs will be considered nonrecurring.



ELEMENTS OF COST

DESIGN/ENGINEERING	HOURS	2AA
	LABOR	2AB
	BURDEN	2AC
LOGISTICS	HOURS	2UA
	LABOR	2UB
	BURDEN	2UC
PRODUCTION	HOURS	4AA
	LABOR	4AB
	BURDEN	4AC
SHOP SUPPORT	HOURS	4CA
	LABOR	4CB
	BURDEN	4CC
PLANNING	HOURS	4VA
	LABOR	4VB
	BURDEN	4VC
QUALITY CONTROL	HOURS	4WA
	LABOR	4WB
	BURDEN	4WC
ENGINEERING MATERIAL		7D
MANUFACTURING MATERIAL		7E
TOOLING & STE MATERIAL		7F
MINOR SUBCONTRACT (PURCHASED PARTS)		7O
MAJOR SUBCONTRACT		7K
MATERIAL PROCUREMENT COST		7P
OTHER COST DOLLARS		8Z
WIND TUNNEL		8W
IDWA		9E
GENERAL ADMINISTRATION		9C

B-70 CONTRACTS, ORDERS, GENERAL ORDERS & SALES ORDERS

<u>CONTRACT NO.</u>	<u>ORDER, GO OR SO NO.</u>	<u>DESCRIPTION</u>	<u>RECORDED COSTS THRU 9-66</u>	<u>WBS ASSIGNMENT</u>
AF33(600)-36599	NA 259	Ph. I-Prelim Engr, Mockups & Engr Develop of Weapon System 110A	\$ 63,659,487	Various
	SO 7146	In-Plant Termination Charges as a result of redirection	80,752	0998
AF33(600)-38669	NA 264	Phase II Part I for 62 B-70's (WS 110A)	87,306,717	Various
	GO 1514	F108/B-70 Common Items	78,148	Various
	GO 7444	Support to Autonetics	448	Various
	SO 7147	In-Plant Termination Charges as a result of redirection	158,966	0998
	NA 267	Phase II Part II of WB 110A & costs charged to one prototype of the XB-70 when program was redirected on 12-3-59	223,864,964	Various
	GO 1504	Wing design, develop & fab (Transferred to NA 267 when program redirected)	61,251	010102
	GO 1505	Horizontal & vertical surfaces design, devel & fab (transferred to NA 267 when program redirected)	23,348	0101
	GO 1506	Upper forward intermediate fuselage design, devel & fab (transferred to NA 267 when program redirected)	11,697	010105
	GO 1508	F108/B-70 common items	708	Various
	GO 1510	Tooling support to Columbus Division	16,420	08
	GO 1512	Common F108/B-70 Training Support	50,593	0991
	GO 1515	Tooling Support to Columbus Division	2,287	08
	GO 1520	Tooling Support to Columbus Division	4	08
	GO 1522	Mfg Devel Program - Assembly Joining	83,601	03
	GO 1523	Design, Mfg & Testing of Electric Thrust Control Actuator Gearboxes for J93 Engines	353,401	01030603
	GO 1524	Manufacturing Development Program	723,675	03
	GO 1527	Spares	13,665	0660

<u>CONTRACT NO.</u>	<u>ORDER, GO OR SO NO.</u>	<u>DESCRIPTION</u>	<u>RECORDED COSTS THRU 9-66</u>	<u>WBS ASSIGNMENT</u>
AF33(600)-38669 (Continued)	GO 6513	Support to Autonetics	\$ 13,882	Various
	GO 9724	Common F108/B-70 Training Support	79,878	0991
AF33(600)-42058	NA 274	11 XB-70's added to Program on 9-19-60	42,870,897	Various
	NA 278	Program Redirected to 2 prototypes on 4-10-61 Costs Peculiar to the 2 Vehicles	486,804,382	Various
	NA 286	Veh #3 added on 3-13-63 & cancelled 3-9-64	59,318,278	Various
	GO 1525	Tooling	8,691,688	08
	GO 1528	Flight Test Spares	20,626,583	0660
	GO 1529	Flight Test GSE	4,362,354	0550
	GO 1530	Manufacturing Development Program	73,110	03
	GO 1531	Support to Autonetics	323	Various
	GO 1535	Support to Autonetics	1,133	Various
	GO 1536	Improvement Techniques Program	353,024	Various
	GO 1537	Support to Autonetics	629	Various
	GO 1539	Repair Struc Damage during Proof-Load Testing	434,234	0101
	GO 6470	Design, Manufacture & Test Equipment Bay Racks	113,620	0101
	GO 6576	Support to Autonetics	83	Various
	SO 7085	In-Plant Termination Charges	404,325	0998
	SO 9048	In-Plant Termination Charges	5,808	0998
	SO 9729	In-Plant Termination Charges	1,618,915	0998
AF33(657)-12395	NA 281	Flight Test Program	32,683,906	0441
	GO 1538	Depot Maintenance - Overhaul & Repair	5,603,290	044102
	SO 9049	In-Plant Termination Charges	12,501	0998

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Exhibit 5

# LEDGER ACCOUNT MATRIX

## LEGEND

<u>WBS</u>		<u>EOC</u>	
VAR	= Various	All	= Many EOC's as determined by the format of the accounting records.
<u>SDW</u>			
2A	= Eng. SDW	4V	= Planning
4A	= Mfg. SDW	7E	= Mfg. Mat'l.
4P	= Tooling SDW	7F	= Tooling Mat'l.
4W	= Test SDW	7O	= Purchased Parts
8Z	= Other SDW	8Z	= Other Cost

L/A NO.	DESCRIPTION	WBS	SDW	EOC
30XX	Rework and Replacement			
3011	Rework - Defective Labor	VAR	4A	All
3021	Replacement - Material & Parts Due to Defective Material	VAR	4A	All
3031	Rework or Replacement - Engineering Changes	VAR	4A	All
3033	Rework and Replacement - Normally Purchased Parts & Equipment	VAR	4A	All
3041	Replacement - Material & Parts Due to Defective Labor	VAR	4A	All
3051	Rework - Government Furnished Equipment	VAR	4A	All
3061	Replacement - Lost Parts	VAR	4A	All
32XX	Contract Flight - Production Aircraft			
3211	Engine Run-Up Line	0440	4A	All
3221	Pilots' Time	044101	2A	All
3231	Operational Costs - Fuel, Oil, Etc.	044102	4A	All
33XX	Packing & Shipping			
3312	Major Production Contract Item	VAR	4A	All
3321	Spares	0660	4A	All

L/A NO.	DESCRIPTION	WBS	SDW	EOC
34XX	Direct Costs			
3411	Materials	VAR	4A	7E
3412	Company Furnished Equipment	VAR	4A	7E
3413	Materials & Equipment - Normally Purchased Parts & Equip. Fabricated at NR	VAR	4A	7E
3421	Labor - Fabrication and Assembly	VAR	4A	All
3423	Labor - Fabrication and Assembly of Parts & Equip. Normally Purchased	VAR	4A	All
3424	Production Planning Direct Labor	VAR	4A	4V
3425	Production Planning Direct Labor - Spares Planning	0660	4A	4V
3426	Production Planning Direct Labor - Spares Maintenance	0661	4A	4V
3427	Production Engineering Direct Labor	VAR	4A	All
3441	Purchased Labor - Manufacturing	VAR	4A	All
3442	Purchased Labor - Material Division	VAR	4A	All
3459	Subcontracted NR - Designed Parts Normally Fabricated at NR	VAR	4A	70
3461-3489	Purchased Components - Purchased Labor	VAR	4A	All
35XX	Tooling			
3513	Design & Fabrication of Tools Normally Purchased	0880	4P	All
3520	Design & Fabrication of Detail Tools	0880	4P	All
3521	Design & Fabrication of Tubing Line Templates	0880	4P	All
3522	Design & Fabrication of Assy Tools Other Than Electrical	0880	4P	All
3523	Design & Fabrication of Electrical Assy Tools, Jig Boards, Etc.	0880	4P	All
3524	Design & Fabrication of Tool Masters and Plaster Mockups	0880	4P	All
3525	Design & Fabrication of Special Welding Heads, X-Ray Heads, Machine Heads, Attaching Fixtures for Special Heads, Control Panels and Control Consoles for Welding Jigs	0880	4P	All
3526	Purchased Tooling - Special Welding Heads, X-Ray Heads, Machine Heads, Attaching Fixtures for Special Heads, Control Panels and Control Consoles	0880	4P	7F
3527	Purchased Tooling - Cost of Tools, Per Purchase Orders, Required for Use at NR Plants	0880	4P	7F
3528	Purchased Subcontractor Tooling	0880	4P	7F
3529	Purchased Vendor Tooling	0880	4P	7F
3530	Design & Fabrication of Special Electrical Test Equipment	07	4A	All



L/A NO.	DESCRIPTION	WBS	SDW	EOC
3531	Design & Fabrication of Special Supplemental Tooling	0881	4P	All
3532	Design & Fabrication of Material Handling & Access Equipment	0882	4P	All
3533	Design & Fabrication of Special Test Equip - Other Than Elec.	07	4A	All
3534	Purchased Tooling - Cost of Tools, Per Purchase Orders, for Special Electrical Test Equipment	07	4A	7F
3535	Purchased Tooling - Cost of Tools, Per Purchase Orders, for Special Supplemental Tooling	0881	4P	7F
3536	Purchased Tooling - Cost of Tools, Per Purchase Orders, for Special Handling & Access Equipment	0882	4P	7F
3537	Purchased Tooling - Cost of Tools, Per Purchase Orders, for Special Test Equipment, Other Than Electrical	07	4A	7F
3538	Design & Fabrication of Special Test Equipment Other Than Electrical (Plant Engineering Responsibility)	07	4A	All
3540	Design & Fabrication of Special Test Equip. Normally Purchased	07	VAR	All
3539	Purchase Tooling - Special Test Equipment, Other Than Electrical (Plant Engineering Responsibility)	07	4A	7F
3541	Purchased Parts Tooling - Cost of Tools, Per Purchase Orders, Required by Vendors to Manufacture NR Designed Parts Normally Fabricated at NR	0880	4P	7F
3551	Cost of Duplicate Tooling Supplied to Subcontractors	0880	4P	All
3561	Design & Fabrication of Special Electrical Test Equipment	07	4W	All
3562	Purchased Tooling - Special Electrical Test Equipment	07	4W	7F
3563	Design & Fabrication of Special Test Equip - Other Than Elec.	07	4W	All
3564	Purchased Tooling - Special Test Equipment Other Than Elec.	07	4W	7F
36XX	Tool Maintenance and Obsolescence			
3610	Design Change And/Or Rework of a Completed Tool - Design and Fabrication of Detail Tools	0880	4P	All
3612	Design Change And/Or Rework of a Completed Tool - Design and Fabrication of Assy Tools Other Than Elec.	0880	4P	All
3613	Design Change And/Or Rework of a Completed Tool - Design and Fabrication of Tools Normally Purchased	0880	4P	All
3614	Design Change And/Or Rework of a Completed Tool - Design and Fabrication of Tool Masters, Forms, or Plaster Mockups	0880	4P	All
3616	Design Change And/Or Rework of a Completed Tool - Design and Fabrication of Electrical Assembly Tools	0880	4P	All
3617	Design Changes And/Or Rework of a Completed Tool - Design and Fabrication of Special Welding Hands, Machine Heads, Etc.	0880	4P	All

L/A NO.	DESCRIPTION	WBS	SDW	EOC
3621	Tool Proving - Labor and Materials	0880	4P	All
3622	Fabrication And/Or Rework of Brazing Retorts	0880	4P	All
3623	Fabrication And/Or Rework of Copper Sheet for Brazing Retorts	0880	4P	All
3624	Tooling - Packing & Crating for Shipment to Subcontractors	0880	4P	All
3630	Design Change And/Or Rework of a Completed Tool - Design and Fabrication of Special Electrical Test Equipment Used by Mfg.	07	4A	All
3631	Costs Associated with Start Up and Close Out of Work Under Contract	0990	4A	All
3632	Design Change And/Or Rework of a Completed Tool - Design and Fabrication of Material Handling & Access Equipment	0882	4P	All
3633	Design Change And/Or Rework of a Completed Tool - Design and Fabrication of Special Supplemental Tooling	0881	4P	All
3634	Design Change And/Or Rework of a Completed Tool - Special Test Equipment Other Than Electrical-Plant Eng. Responsibility	07	4A	All
3637	Design Change And/Or Rework of a Completed Tool - Design & Fabrication of Special Test Equipment, Other Than Electrical	07	4A	All
3638	Design Change And/Or Rework of a Completed Tool - Special Electrical Test Equipment Used by QC Division	07	4W	All
3639	Design Change And/Or Rework of a Completed Tool - Special Test Equipment, Other Than Electrical - Used by QC Division	07	4W	All
3640	Design Change And/Or Rework of a Completed Tool - Special Test Equipment Normally Purchased	07	4A	7F
3641	Removal, Handling, Preparation for Storage, and Return from Storage of All Production Tools	08	4P	All
3650	Maintenance of Tooling	08	4P	All
3651	Maintenance of Tooling - General - Replacement Due to Usage, Repair of Completed Tool, Release of Temporary Tool, and Rework of Tooling for Causes Other Than Eng. Changes	08	4P	All
3660	Tool Planning Direct Labor	08	4P	4V
3661	Cost Value of Tools Totally Obsolete by Changes - Acctg. Only	08	4P	All
3671	Maintenance of Special Supplemental Contract Tooling	0881	4P	All
3672	Maintenance of Special Electrical Test Equipment	07	VAR	All
3674	Maintenance of Material Handling & Access Equipment	0882	4P	All
3675	Maintenance of Special Test Equip. Other Than Electrical	07	4A	All
3676	Maintenance of Special Electrical Test Equipment	07	4W	All
3677	Maintenance of Special Test Equipment Other Than Electrical	07	4W	All
3678	Maintenance of Special Test Equipment Other Than Electrical	07	4A	All

L/A NO.	DESCRIPTION	WBS	SDW	EOC
3681	Shop Contact	08	4P	A11
3682	Tool Engineering for Diminsional Contract Tools	0880	4P	A11
3683	Tool Master Lines	08	4P	A11
3684	X-Ray Film Used in Inspection	0997	4A	7F
3685	Payments for the Use of Vendor-Owned Tooling	08	4P	7F
3686	Tool Engineering for Non-Dimensional (TSC) Contract Tools	0881	4P	A11
3679	Tooling Cost Not Otherwise Classified	08	4P	A11
37XX	Engineering & Logistics Support			
3701	Design & Drafting	VAR	2A	A11
3702	Purchased Design & Drafting	VAR	2A	A11
3713	Static Test Article	VAR	2A	A11
3716	Mobile Training Unit	0991	2A	A11
3717	Microfilming	0992	2A	A11
3718	Instrumentation	0112	2A	A11
3719	Special Tools and Ground Handling Equipment	08	2A	A11
3720	Partial Mockup to be Delivered to Customer	VAR	2A	A11
3731	Logistics Support Programming	0991		
		0992	2A	A11
		0660		
3741	Supply Support - Airborne Spares	0660	2A	A11
3742	Supply Support - Ground Support Equip. & Spares	0660	2A	A11
		0550		
3743	Supply Support - Training Aids & Spares	0991	2A	A11
		0660		
3744	Supply Support - Stock Management	0660	2A	A11
3745	Supply Center - Warehousing	05&06	2A	A11
3751	Maintenance Scheduling	022303	2A	A11
3753	Product Improvement Analysis	0223	2A	A11
3754	Maintenance Analysis	022302	2A	A11
3760	Flight Manuals	0992	2A	A11
3761	Maintenance Instructions Manual	0992	2A	A11
3762	Structural Repair Manual	0992	2A	A11
3763	Illustrated Parts Breakdown Manual	0992	2A	A11
3764	Parts Application Data List	0992	2A	A11

L/A NO.	DESCRIPTION	WBS	SDW	EOC
3765	Numerical Drawing List	0992	2A	All
3766	Publication Bulletins (TCTO's)	0992	2A	All
3767	Modification Instruction Manual	0992	2A	All
3768	Technical Training Transparencies and Slides	0992	2A	All
3769	Inspection Requirements Manual	0992	2A	All
3770	Class Room Training Parts Data and Charts	0992	2A	All
3771	Overhaul Instruction Manual	0992	2A	All
3772	Motion Pictures	0992	2A	All
3773	Organization Maintenance Manuals (Systems Type)	0992	2A	All
3774	Inspection Work Cards and Sequence Charts	0992	2A	All
3775	Field Maintenance Instructions Manual	0992	2A	All
3777	Operation And/Or Service Instructions Manual	0992	2A	All
3778	Logistics Support Manual	0992	2A	All
3779	Work Unit Code Manual	0992	2A	All
3780	Operation and Inflight Maintenance Manual	0992	2A	All
3781	Structural Repair Illustrated Document	0992	2A	All
38XX	Engineering Test Reports and Services			
3801	Test Reports - Low Speed Wind Tunnel Model	VAR	2A	All
3802	Test Reports - High Speed Wind Tunnel Model	VAR	2A	All
3803	Test Reports - Static Article	VAR	2A	All
3804	Test Reports - Instrumentation	VAR	2A	All
3805	Test Reports - Mockup	VAR	2A	All
3806	Flight Test - First Flying Article	VAR	2A	All
3807	Flight Test - Second Flying Article	VAR	2A	All
3808	Flight Test - Third Flying Article	VAR	2A	All
3809	Demonstration	VAR	2A	All
3810	Tests - Board of Inspection and Survey - NAVY (BIS)	VAR	2A	All
3811	Test Reports - Engine Test	VAR	2A	All
3812	Test Reports - Stress	VAR	2A	All
3813	Test Reports - Weight	VAR	2A	All
3814	Test Reports - Aerodynamics	VAR	2A	All
3815	Test Reports - Thermo Dynamics	VAR	2A	All
3816	Test Reports - Vibration & Flutter	VAR	2A	All
3817	Test Reports - Aerophysics	VAR	2A	All
3818	Test Reports - Laboratory	VAR	2A	All
3819	Test Reports - Equipment Tests	VAR	2A	All

L/A NO.	DESCRIPTION	WBS	SDW	EOC
3820	Test Reports - Structural Test Sections	VAR	2A	All
3821	Packaging Studies	022304	2A	All
3822	Test Reports - Dynamic Motions	VAR	2A	All
3823	Test Reports - Testing Equipments	07	2A	All
3831	Engineering Programming	VAR	2A	All
3832	Air Vehicle	VAR	2A	All
3833	Fire Control System	VAR	2A	All
3834	Missiles	VAR	2A	All
3835	Missile and Traffic Control Equipment	VAR	2A	All
3836	Propulsion and Air Induction Control System	VAR	2A	All
3838	Air Frame	VAR	2A	All
3839	Environmental Control	VAR	2A	All
3841	Flight Control & Central Air Data System	VAR	2A	All
3843	Secondary Power Generation & Distribution	VAR	2A	All
3844	Personnel Accommodation & Escape System	VAR	2A	All
3845	Base Operations Ground Support, Ground Cooperational and Deport Equipment	0550	2A	All
3846	Eng. Maintenance of Flight Test GSE	0551	2A	All
3848	Training Equipment	0991	2A	All
3849	Personnel Training	0991	2A	All
3850	Technical Services	0991	2A	All
3851	Publications	0992	2A	All
3852	Target Drone	VAR	2A	All
3853	Logistics	0223 0660	2A	All
3854	Offensive Sub-Systems	VAR	2A	All
3855	Defensive Sub-Systems	VAR	2A	All
3860	Tool Planning Direct Labor - Tools for Eng. Test or Mockup Parts	08	2A	All
3871	Production Planning Direct Labor - Eng Test and Mockup Parts	VAR	2A	4V
3873	Normally Purchased Eng. Test Items Fabricated at NR	07	2A	All
3881	Test Reports - Gunfire Test Section	VAR	2A	All
3882	Test Reports - Dead Load Structures Rig	VAR	2A	All
3883	Test Reports - Slosh & Gunfire Fuel Tests	VAR	2A	All
3884	Test Reports - Flight Simulator	VAR	2A	All
3885	Test Reports - Training Program - Customers' Personnel	0991	2A	All
3886	Test Reports - Indoctrination - Customers' Personnel	0991	2A	All

L/A NO.	DESCRIPTION	WBS	SDW	EOC
39XX	Direct Expense			
3901	Inbound Transportation	VAR	2A	8Z
3904	Off-Site Labor - Flight Test Instrumentation	VAR	VAR	All
3906	Off-Site Labor - Flight Test - 1st Flying Article	VAR	VAR	All
3907	Off-Site Labor - Flight Test - 2nd Flying Article	VAR	VAR	All
3911	Insurance	VAR	8Z	8Z
3921	Traveling Expense	VAR	VAR	8Z
3931	Off-Site Labor - Engineering Programming	VAR	2A	All
3933	Off-Site Labor - Fire Control System	VAR	VAR	All
3934	Off-Site Labor - Missiles	VAR	VAR	All
3935	Off-Site Labor - Missile & Traffic Control Equipment	VAR	VAR	All
3936	Off-Site Labor - Propulsion & Air Induction Control Systems	VAR	VAR	All
3938	Off-Site Labor - Air Frame	VAR	VAR	All
3939	Off-Site Labor - Environmental Control	VAR	VAR	All
3941	Off-Site Labor - Flight Control & Central Air Data Systems	VAR	VAR	All
3943	Off-Site Labor - Secondary Power Generation & Distribution	VAR	VAR	All
3944	Off-Site Labor - Personnel Accommodation & Escape Systems	VAR	VAR	All
3945	Off-Site Labor - Base Operations Ground Support, Ground Operational and Depot Equipment	0550	VAR	All
3948	Off-Site Labor - Training Equipment	0991	VAR	All
3949	Off-Site Labor - Personnel Equipment	0991	VAR	All
3950	Off-Site Labor Technical Services	VAR	VAR	All
3951	Off-Site Labor - Publications	0992	VAR	All
3952	Off-Site Labor - Target Drone	VAR	VAR	All
3953	Off-Site Labor - Logistics	0223	VAR	All
3954	Off-Site Labor - Offensive Sub-System	VAR	VAR	All
3955	Off-Site Labor - Defensive Sub-System	VAR	VAR	All
3971	Vendors' Adjustments	VAR	8Z	8Z
3973	Vendors' Termination Claims	VAR	8Z	8Z
3974	Post-Termination Expenses	VAR	8Z	All
3975	Raw Material Inventories Delivered to U.S. Government	VAR	8Z	7E
3980	Tool Planning	08	4A	4V
3981	Miscellaneous Direct Expense	VAR	VAR	8Z
3982	Cost of Interplant Movement of Work in Process	VAR	8Z	8Z
3983	Tool Planning	08	4A	4V
3987	Direct Expense - Off-Site Labor	VAR	8Z	8Z
3999	Cost of Sales	VAR	8Z	8Z



### SECTION III SCHEDULE/MILESTONE DATA

The established objectives for the schedules section of the study team during Phase I were to (1) ascertain the quantity, depth and completeness of available schedule/milestone data, (2) identify those items of the WBS which were considered as "schedule drivers" to be studied during Phase II and (3) develop formats, forms, and extent of data to be used to display the schedule/milestone information.

Objective #1: Ascertain the quantity, depth, and completeness of available schedule/milestone data.

The following B-70 schedule/milestone documentation is available and will be utilized during Phase II data recording:

- Program Plans
- Master Phasing Schedules
- Manufacturing Schedules
- Flight Test Schedules
- Development Test Schedules
- Program Summary Reports
- Program Status Reports
- PERT Networks
- PERT Analysis Reports
- Program Redirection Summaries
- Program Chronologies
- Special Schedules
- Flight Test Reports
- Briefings
- Correspondence
- Minutes of Meetings
- Contract Schedules
- Performance Reports
- Schedule Studies

In the early stages of the B-70 Program, a separate data control section was established and has maintained a numerical listing of publications developed by North American Rockwell on the B-70 (Ref: NA 58-912). This listing will be utilized to retrieve data on specific systems or time periods not covered by the aforelisted schedule/milestone documentation.

For a period of approximately three years during the peak of manufacturing effort on Air Vehicles 1 and 2, PERT reporting was maintained on 13 discrete elements of the program. In addition, a summary network was developed on Air Vehicle #1. This data will provide milestone actuals from the piece part level up through major vehicle assemblies for this period of time.



Personnel have been identified that were involved in B-70 scheduling/reporting and will be available for support during Phase II of the study.

In conclusion, it is felt that milestone data is available on all hardware development elements of the Work Breakdown Structure to a degree of quantity, depth and completeness required in the recap of the B-70 program.

Objective #2: Identify those items of the WBS which were considered as "Schedule Drivers" to be studied during Phase II.

Discussions with key program personnel and preliminary review of historical data indicate that the prime schedule "drivers" on development of the B-70 were funding and airframe structure (WBS item 01-01). The schedule effects of the austerity program were experienced in the area of soft tooling impacts in mating and having to utilize AV #1 as a simulator prior to first flight. The airframe structures subsystem development problems, consisting primarily of honeycomb development with its associated fabrication methods and inspection techniques, overshadowed the other subsystems (WBS items 01-02 through 01-12) from a schedule significance standpoint. Therefore, the "Schedule Drivers" will appear on a series of charts aligned with AV #1 and the structures subsystem (WBS 01-01). The technical drivers listed under Section IV, Exhibit 28 will serve as a guide for acquisition of milestone data on all subsystems other than structures.

Objective #3: Develop formats, forms, and extent of data to be used to display the schedule/milestone information.

Significant program milestones, key functions, and milestones common to all subsystems were established and appear on the sample forms in Exhibit 7 through 20.

During Study Phase II, the schedule/milestone data will be recorded at 4 levels: (1) Overall Program, (2) Air Vehicle, (3) Subsystem, and (4) Subsystem Components (below WBS level 5). Further descriptions of reporting forms and sample data by reporting level are as follows.

#### Level 1 (Overall Program)

##### Exhibit 7, page 32

A program development summary chart will display the significant flight and ground test program milestones by test category and test span periods.

##### Exhibit 8, page 33

A summary chart displaying issuance date of all master phasing schedules and revisions. This chart will include the flight test schedules and revisions.





Exhibit 9, page 34

A copy of each master phasing schedule/flight schedule and revisions will be provided.

Exhibit 10, page 35

A narrative summary will be included to identify the reason for and significant effects of each schedule and revision.

## Level 2 (Air Vehicle)

Exhibit 11, page 36

A vehicle development chart covering the time up to 1st flight will be provided for both AV #1 and #2. This chart will display the development spans of the major assemblies and their point in time of mating or installation.

Exhibit 12, page 37

A second vehicle development chart for both AV #1 and #2 will cover the entire flight testing period. It is planned that all flights and nonscheduled modification periods will be noted.

Exhibit 13, page 38

In support of the aforementioned vehicle development charts there will be a tabulation of dates reflecting the milestones displayed graphically.

Exhibit 14, page 39

A design/programmatic chart will be provided for both AV #1 and #2 to display the significant events considered as schedule and/or technical drivers.

Exhibit 15, page 40

A narrative report explaining the design/programmatic events will be included for both vehicles.

Exhibit 16, page 41

Due to the program significance, from a cost, schedule and technical aspect associated with wing and fuselage joining on AV #1, a separate chart will be developed to provide further visibility during this period of time.



### Level 3 (Subsystems)

Exhibit 17, page 42

Each subsystem (WBS 01-01 thru 01-12) will have a summary development chart broken out by engineering, test, material and manufacturing. Each function on the chart will display significant events when they occurred, i.e., development tests complete. If, during the conduct of Phase II, significant subsystem unique milestones are discovered, they will be added.

Exhibit 18, page 43

A tabulation of dates will support each subsystem development summary chart.

Exhibit 19, page 44

A design/programmatic chart will be provided for each subsystem to display the significant events considered as schedule and/or technical drivers.

Exhibit 20, page 45

A narrative report explaining the design/programmatic events will be included for each subsystem. The information appearing on this exhibit will be developed in conjunction with the technical study personnel.

### Level 4 (Subsystem Components)

For each subsystem component, any item below WBS level 5 considered to be of program schedule and/or technical significance, a separate design/programmatic chart (Ref: Exhibit 19) and a narrative report (Ref: Exhibit 20) will be provided. This data will also be provided for the wind tunnel test under WBS item 02-21.

### Other

A listing of abbreviations and definitions of terminology appearing on the schedule data will be provided.

Sketches displaying the Air Vehicle assembly sequence will be provided.

### General

The Phase II schedule/milestone data will cover the established study time frame except for the wind tunnel test programs which were initiated prior to 1 January 1958. It is planned that milestone data will be provided on the entire wind tunnel test programs.



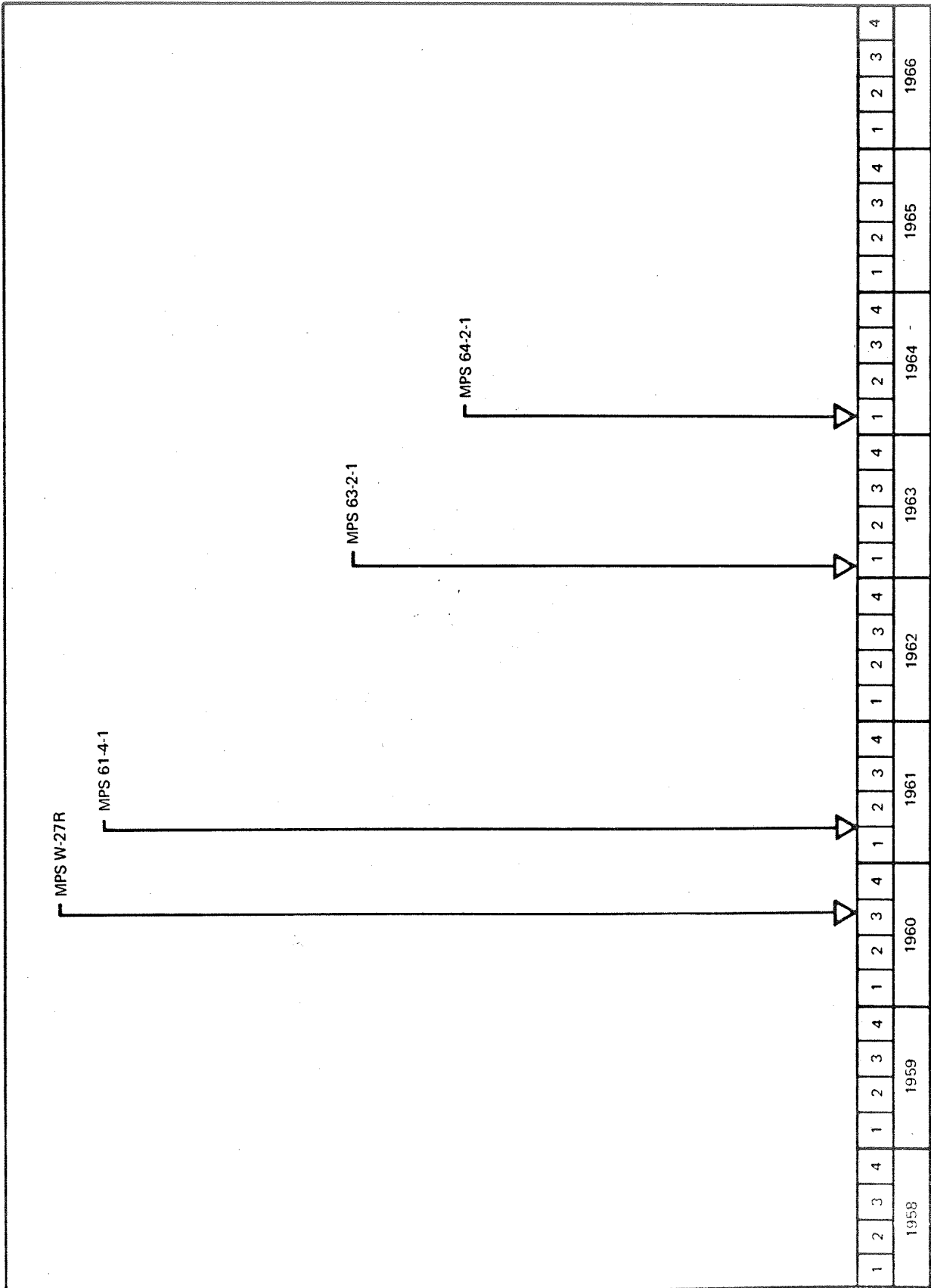
If, during the course of Phase II, any GFE is found to have had schedule significance, it will be reported on at the applicable WBS level 5 element.

For purposes of this study the term "schedule" applies only to the documents utilized to plan and status the B-70 program. A sample of these documents appears under Exhibit 9 of this report. All dates appearing on the various hardware charts provided during Phase II will be actual milestones as recorded, not scheduled dates.

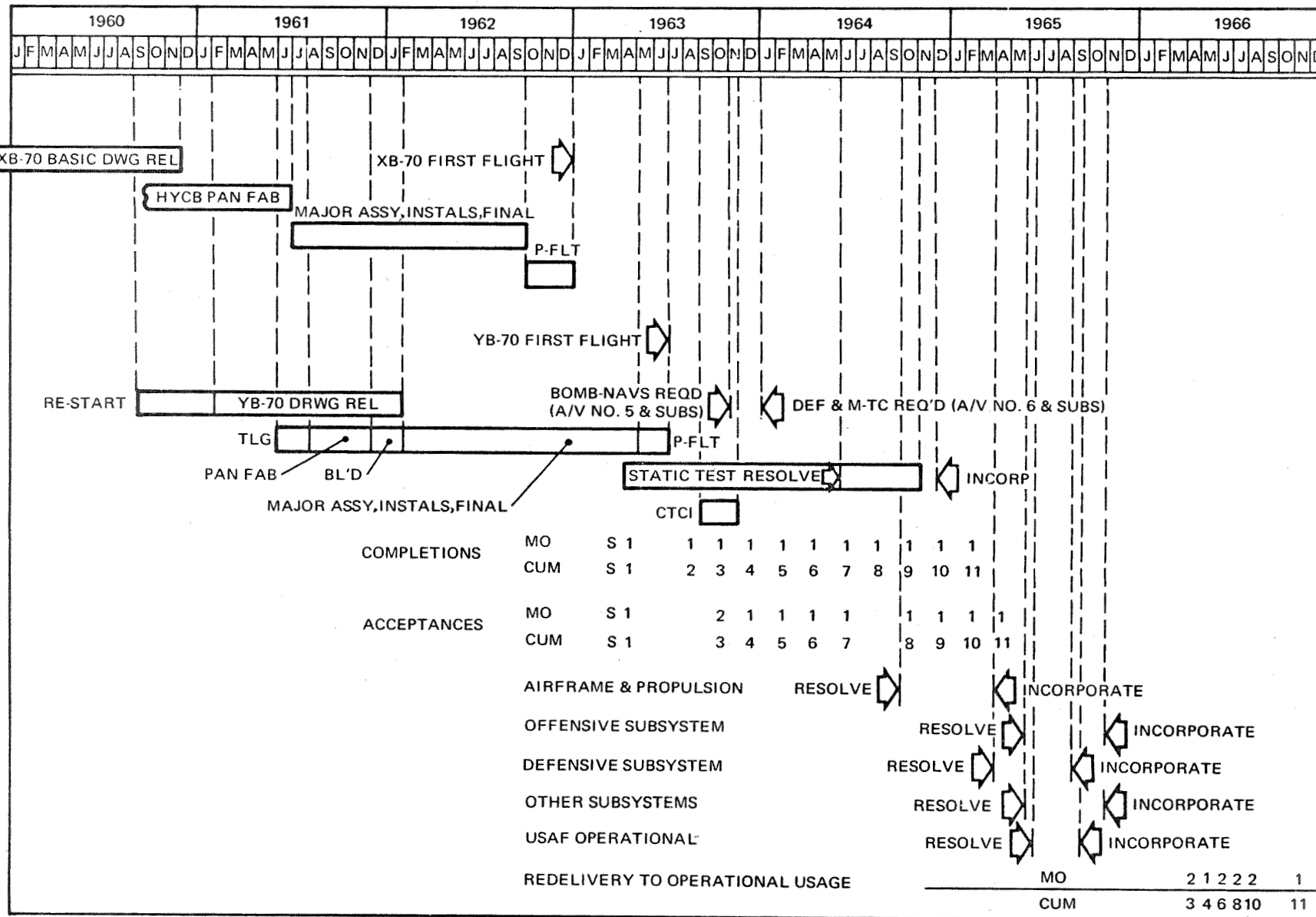




MASTER PHASING/FLIGHT SCHEDULES



# PLAN W-27R (ONE XB-70 & 11 YB-70'S)

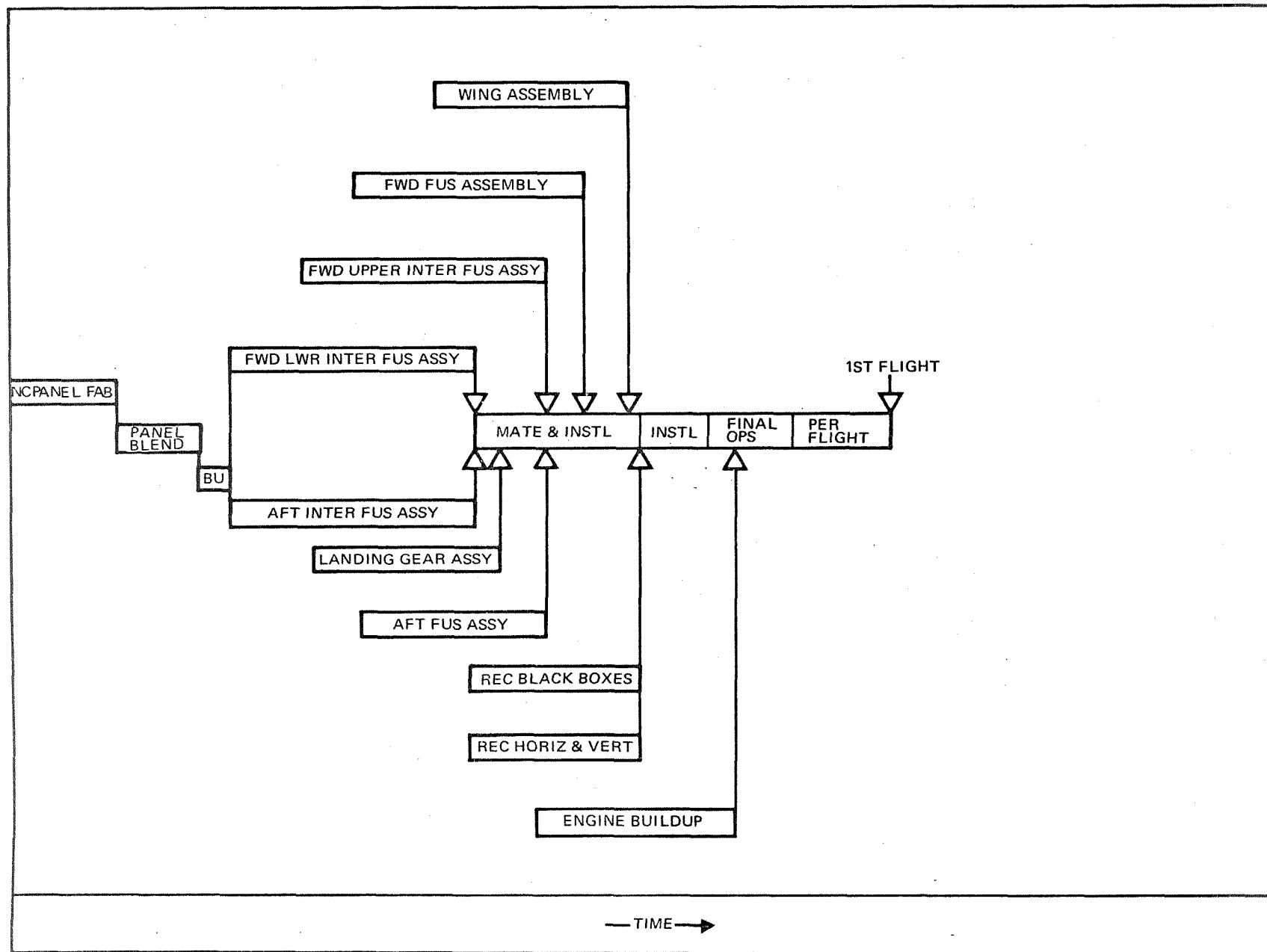




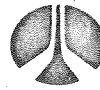
## SCHEDULE NARRATIVE

9-21-60 Master Phasing Schedule W-27R was issued to implement the addition of the YB-70 (11 Air Vehicles) Development Program (General Order NA 274). This schedule maintained a first flight date of 12-30-62 for the XB-70 but revised the manufacturing schedules by adding one month to the final installations and pre-flight periods. In addition, the established XB-70 schedule included the addition of those changes agreed to during the development engineering inspection of July 18, 1960. This schedule established a YB-70 first flight date of June 1963 with two month vehicle delivery centers after the 2nd YB-70 delivery in August 1963.

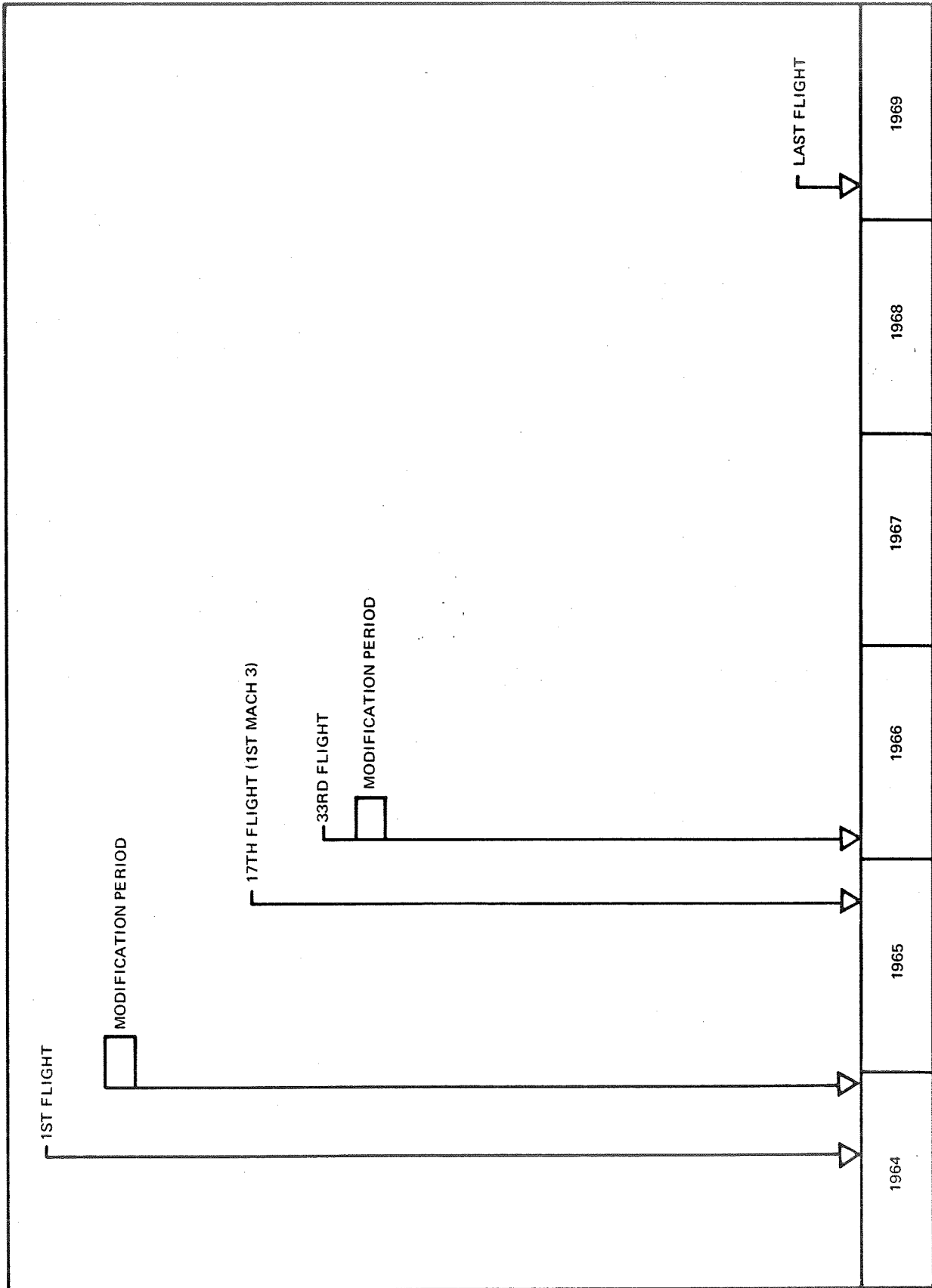
# XB-70A AV NO. 1 MILESTONES







# XB-70A AV NO. 1 FLIGHT OPERATIONS

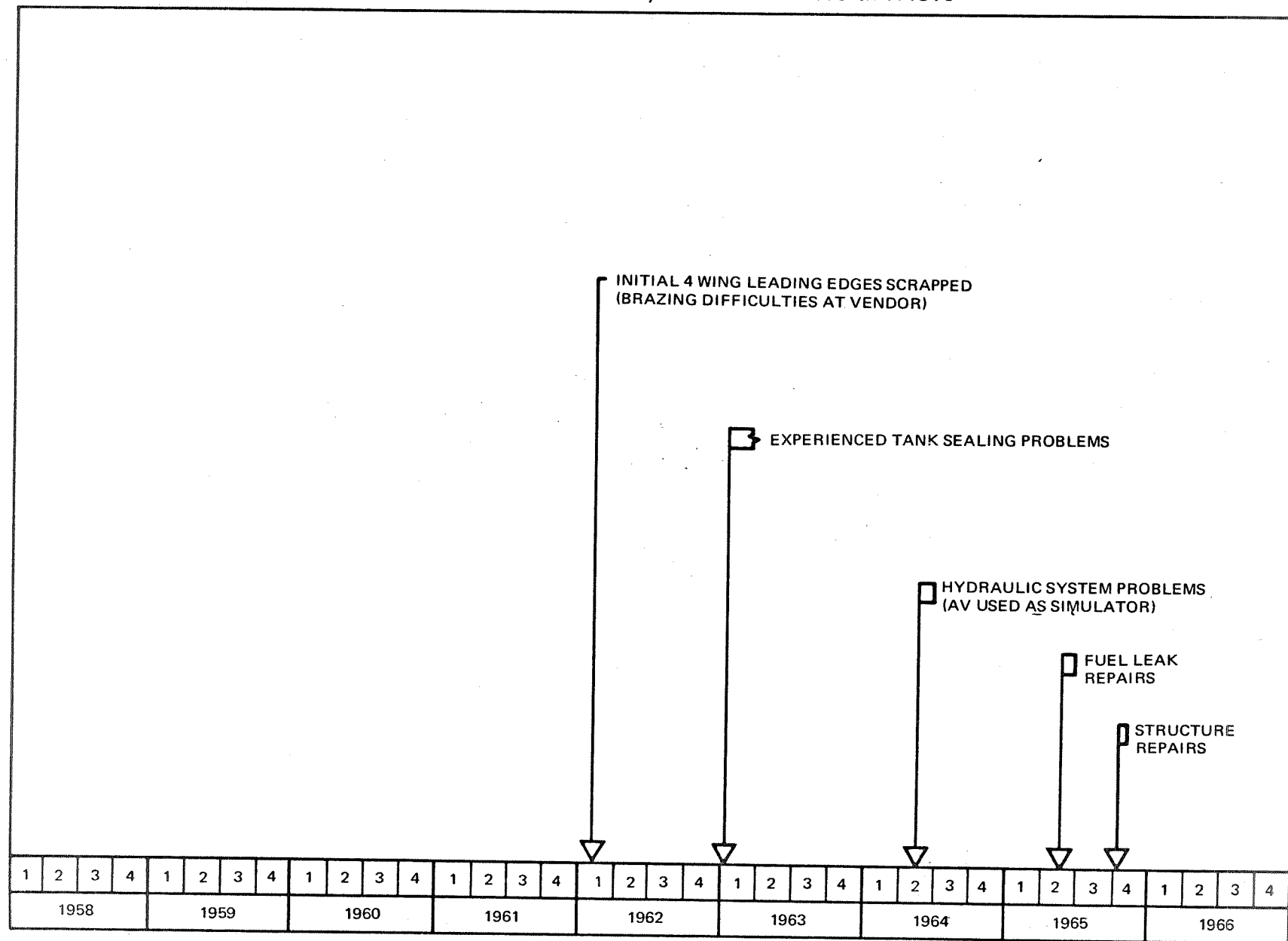




XB-70A AV #1  
TABULATION OF DATES

	<u>START</u>	<u>COMPLETE</u>
Wing Assembly	11-17-61	7-27-62
Forward Fuselage Assembly		
Forward Upper Intermediate Fuselage Assembly		
Forward Lower Intermediate Fuselage Assembly		
Aft Intermediate Fuselage Assembly		
Aft Fuselage Assembly		
Landing Gear Assembly		
Receive Black Boxes		
Receive Horizontal and Vertical Stabilizers		
Engines Buildup		10- -62 (Installed)
Major Sections Mating		
Final Operations		
First Flight		9-21-64
Last Flight		2-04-69

# XB-70A AV NO. 1 DESIGN/PROGRAMMATIC IMPACTS



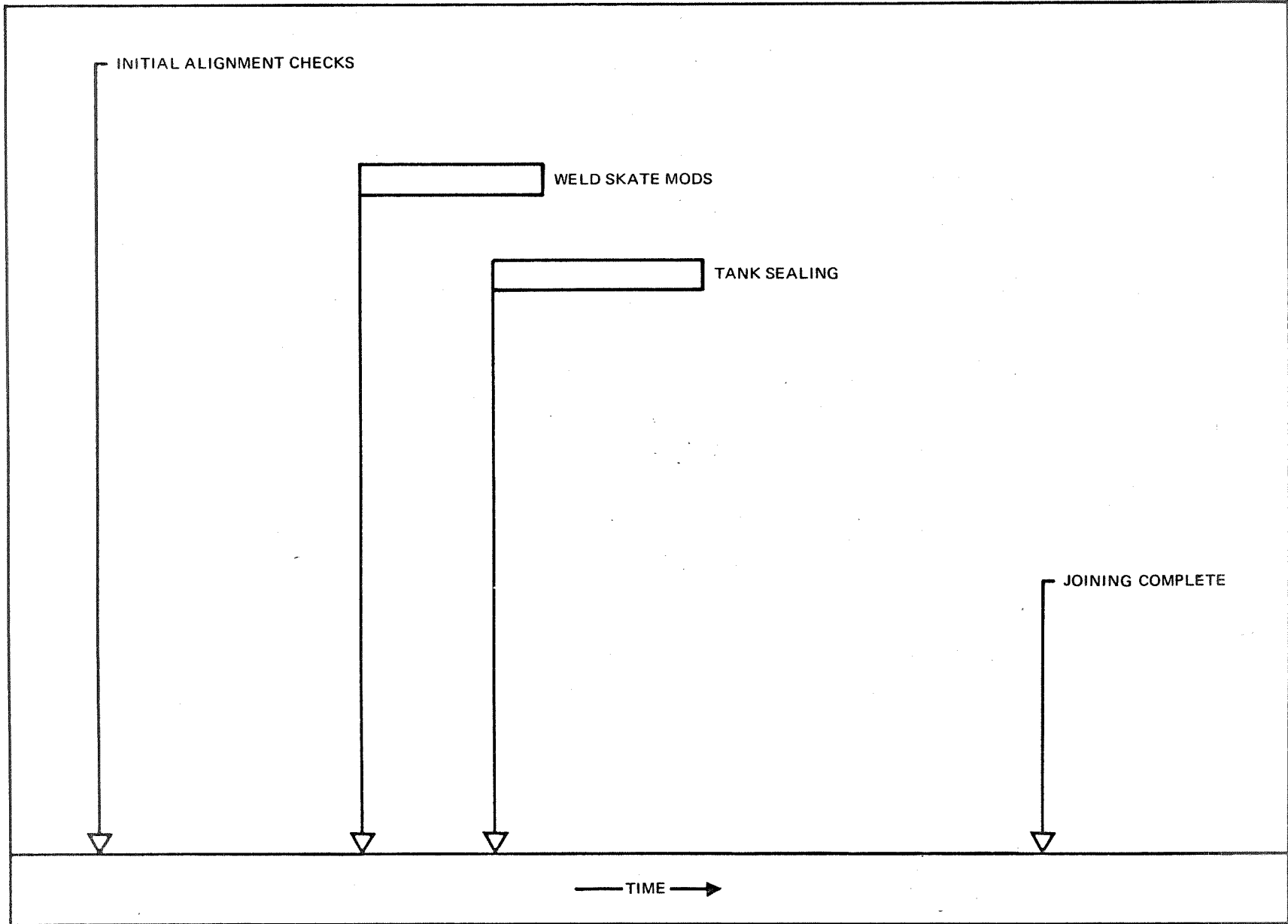


XB-70A AV #1  
DESIGN/PROGRAMMATIC IMPACTS  
NARRATIVE

3.3.3 (10-14-65)

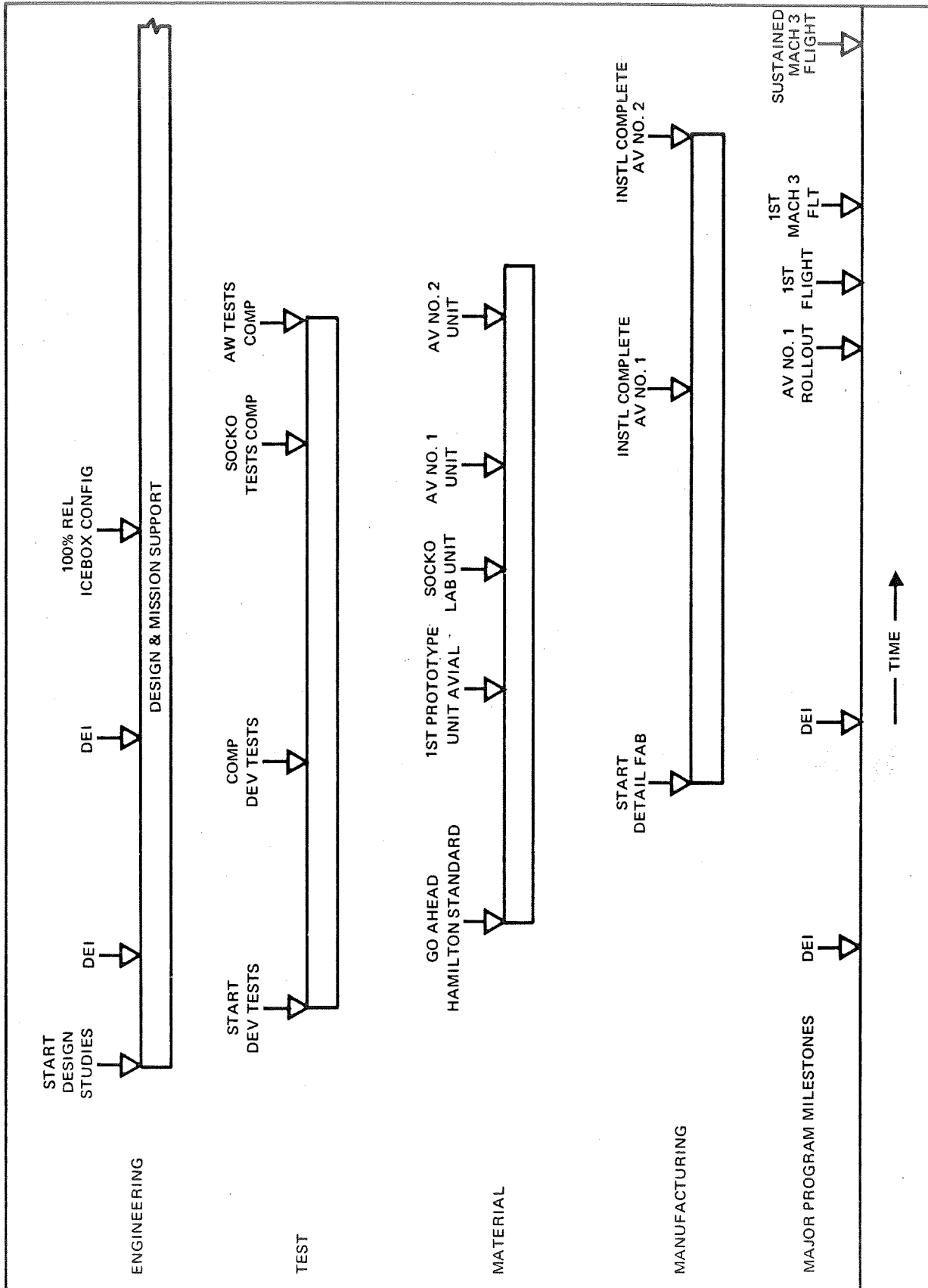
On the 17th flight, Mach 3 was attained for the first time and was maintained for two minutes by pilot A. S. White. Upon deceleration a chase plane noted the loss of a piece of wing skin which led to a decision to abort the remainder of the mission.

# XB-70A AV NO. 1 WING TO FUSELAGE JOINING





# ENVIRONMENTAL CONTROL SYSTEM WBS 01-02



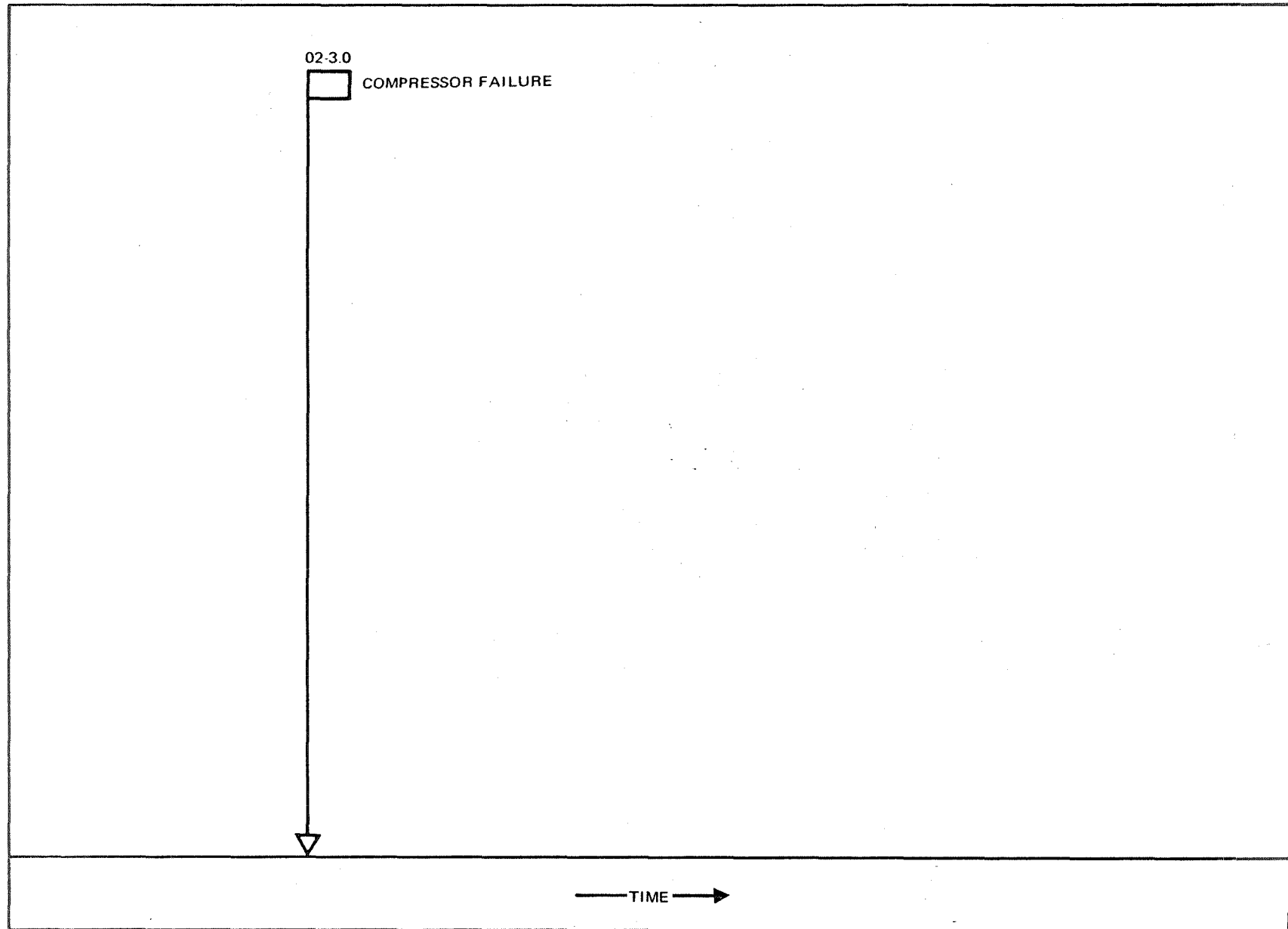


ENVIRONMENTAL CONTROL SYSTEM  
TABULATION OF DATES

WBS 01-02

<u>FUNCTION</u>	<u>MILESTONE</u>	<u>DATE</u>
Engineering	Start Design	_____
	Complete DEI	_____
	100% Release	_____
	(Icebox Config)	_____
Test	Start Devel Tests	_____
	Comp Devel Tests	_____
	Comp SOCKO Tests	_____
	Comp AW Tests	_____
Material	Subcont Go-Ahead	_____
	1st Prototype Avail	_____
	SOCKO Unit Avail	_____
	AV #1 Unit Avail	_____
	AV #2 Unit Avail	_____
Manufacturing	Start Detail Fab	_____
	Comp AV #1 Instl	_____
	Comp AV #2 Instl	_____

# ENVIRONMENTAL CONTROL SYSTEM DESIGN/PROGRAMMATIC IMPACTS WBS01-02







ENVIRONMENTAL CONTROL SYSTEM  
DESIGN/PROGRAMMATIC IMPACTS  
NARRATIVE

WBS 01-02

02-3.0

On (date) a compressor failed during development testing and was traced to a loss of seal between the fan and drive shaft. A design change was issued to revise the seal material which permitted resumption of testing on (date).

02-3.1

- - - -



## ABBREVIATIONS AND DEFINITIONS

A/V      Air Vehicle

AW      Airworthiness

A category of testing selected and, in some cases, modified from a full qualification testing program which assured the satisfactory performance of the components and systems in the XB-70 during the flight test program.

SOCKO      Systems Operational Checkout



## SECTION IV TECHNICAL DATA

This section defines the technical effort expended during the initial phase of the B-70 study. This technical support was essentially limited to determining the technical methodology to be utilized during Phase II and consisted mainly of (1) establishing a detail breakdown of the XB-70 air vehicle subsystems, (2) formulating a Technical Characteristics List to the major assembly level, (3) developing forms for the presentation of the technical data during Phase II, (4) identifying those items of the Work Breakdown Structure which are considered technical drivers, (5) determining the availability, depth, and source identification of the technical data required to support Phase II, and (6) establishing a method of determining state-of-the-art and relative completion percentages for the subsystems and major assemblies.

In order to accomplish the technical objectives, it was deemed necessary to establish a detail breakdown of the XB-70 subsystems and major assemblies. This was achieved by first reviewing the XB-70 contractual documents and management type briefings to define the XB-70 program objectives and then comparing these objectives with the accomplishments to identify a baseline configuration. With this baseline, and using the functional descriptions of the B-70 configuration specifications as a guide, subsystem briefings and special subsystem reports were reviewed to compile the assembly and component details. As a result of this analysis, the sustained Mach 3.0 flight of air vehicle #2 was selected for the baseline configuration and the detail breakdown of this configuration is displayed in the Work Breakdown Structure of Section I under the block titled "Air Vehicle."

During the above study, physical and functional characteristics data of the subsystems and major assemblies were accumulated. These data were then used to formulate an XB-70 Technical Characteristics List which is presented as Exhibit 22 of this section. These data were also used in the development of forms on which the technical data will be presented during Phase II. The Work Breakdown Structure was reviewed by senior technical personnel of each engineering discipline to assure interface continuity and to identify those items considered technical drivers during the development of the XB-70. Consideration was also given to those items which were timely engineered but became schedule drivers in manufacturing due to the requirement of unique fabrication processes or procedures. The technical drivers selected are presented as Exhibit 28 of this section.

A chronological review of the program technical development in a narrative form will be provided at the end of Phase II. This narrative will trace the significant programmatic events from contract inception through sustained Mach 3.0 flight on May 19, 1966. For each technical



driver significant technical and programmatic data will be identified, documented, and prior to submittal, reviewed by each engineering discipline to resolve any discrepancies and to assure continuity of the data presented. The following discussions further review in detail the forms to be utilized for data submitted during Phase II.

Exhibit 23: Technical Description

This will be a series of forms presenting the technical description and functional interface of the air vehicle subsystems and major assemblies. The narration will be identified to the major assembly level with all its minor assemblies, components, and piece parts discussed in general as part of that major assembly. All data will be based on the sustained Mach 3.0 flight of air vehicle #2.

In those areas where technical drivers have been identified, the technical description and functional interface will be discussed in detail to provide continuity between the problem encountered and the associated functional application. This descriptive narration will be presented as part of the technical driver narration which is discussed in a subsequent paragraph.

Exhibit 24: Technical Characteristics Progression Summary

This form will be used to present the technical characteristics to the major assembly level as well as the progression of technical characteristics during the B-70 program. To present the progression of technical characteristics, the original B-70 configuration, the sustained Mach 3.0 configuration, and three intermediate prominent impact points were selected as follows.

March 1959: At this point in time, the last DEI was held on the full weapon system at which time the prime vehicle was still designated the RS-70. It also covers that time period of the full scale B-70 air vehicle mockup as well as a full display of subcontractor major assemblies, components, and piece parts. This description will present the original program concept technical characteristics at a finite development stage.

December 1959: This was the first major redirection of the B-70 Program at which time the full Weapon System 110-A was terminated and the XB-70 Program initiated. The configuration identified for the XB-70, at this time, remained essentially unchanged for air vehicles #1 and #2 through all the program redirections that followed. Comparing the technical characteristics of the XB-70 with the RS-70 will

show the changes that occurred due to the redirection. Comparing the XB-70 description at this time with those that follow will show the technical characteristics development progression until sustained Mach 3.0 flight was attained.

February 1961: The first formal XB-70 DEI was held during this month which also coincides with the last phase of basic engineering release. This time period was selected to provide visibility to technical characteristics changes that occurred prior to and after basic engineering release.

March 1964: The characteristics at this time slice will identify the XB-70 configuration at the onset of the flight test program. By comparing this configuration with that of February 1961, development progress from basic engineering release to the start of the flight test program can be identified. This time slice also provides a baseline for determining the development progress during the XB-70 Flight Test Program.

May 1966: The configuration identified at this time period will be that of air vehicle #2, flight #39 (2-39) that occurred on May 19, 1966, during which sustained Mach 3.0 operation was attained. This configuration was selected as baseline for all subsystem descriptions since the last of the flight test program contractual goals was achieved with the completion of flight #2-39.

The technical characteristics data will be compiled during Phase II by reviewing and analyzing DEI reports, subsystem configuration specifications, subsystem performance specifications, special subsystem reports, development test reports, special briefings, and flight test data documentations. Technical personnel of each responsible engineering discipline will support this data accumulation to assure accuracy of presentation.

Exhibit 25: Development Data Summary

The development data summary will present pertinent development test program parameters identified to the major assembly level. The parameters selected are state-of-the-art rating, percent (%) developed (as of May 1966), and type/number/test hours of the test units and/or models involved in the development testing.



The state-of-the-art rating will be expressed numerically based on definitions established using AFSCM 173-1 (11-28-67) as a guide. This numerical number will be determined by comparing the RS-70 requirements with the existing capabilities at the RS-70 time period using state-of-the-art criteria discussed in subsequent paragraphs. The RS-70 configuration was selected for the state-of-the-art determination since it is the only production configuration ever defined. This selection is considered valid since the development status at program end will also be based on this scheduled production configuration.

The definitions to be used in determining the state-of-the-art ratings are described below. For rating numbers 3, 4 and 5, the following B-70 design criteria will be used as an aid for rating selection.

- A. High temperature application
- B. High pressure/load/acoustic/etc. application
- C. Light-weight/special materials/unique processes required

<u>Rating</u>	<u>Description</u>
1	The item is an off-the-shelf commercial item or a standard military issue which was installed "as is."
2	The item is an off-the-shelf commercial item or a standard military issue which required physical modification only for installation.
3	The item is considered within the state-of-the-art but has no commercial or military counterpart. As an aid, the item was existing but required modification to be compatible with <u>one</u> of the design criteria. Also, any new design or process will have a rating of at least 3.
4	The item is slightly beyond the state-of-the-art, and some development work was required. As an aid, the item was based on an existing concept but required modification to be compatible with <u>two</u> of the design criteria. Also, any new design or process required to be compatible with <u>one</u> of the design criteria will have a rating of 4.
5	The item is substantially beyond the existing state-of-the-art and required major development work. As an aid, any new design or process required to be compatible with at least <u>two</u> of the design criteria or any existing concept requiring modification to be compatible with all <u>three</u> of the design criteria will have a rating of 5.



The percent developed value will be a best judgment value determined by analyses conducted by senior technical personnel of the responsible engineering discipline. The analysis will consist mainly of comparing the expectations of the RS-70 production configuration with the condition level of the XB-70 configuration at program end. Factors influencing this analysis are total test hours, problem solutions (typical production or were they work-around), environments experienced, and subsystem refinements such as accuracy resolution, frequency response, and hysteresis. As an aid in determining the percent complete, the classic "Learning Curve" will be utilized. Exhibit 26 of this section presents this curve and gives an example of its use.

The type, number, and test hours for the test units and/or models will be obtained directly from documented test reports.

Exhibit 27: Technical Driver

This form will be used to describe the function, identify the problem, and discuss the fix(s) and effort expended for each technical driver listed in Exhibit . Each technical driver will be identified by its WBS CODE, and in the narrative discussion, the technical characteristics of that driver will be defined so that specific characteristics may be associated with the problem encountered. These data will be obtained from special subsystem reports, development test reports, laboratory journals, manufacturing records, and flight test data documentation.



# TECHNICAL CHARACTERISTICS LIST

WBS CODE	TITLE	UNITS	CHARACTERISTICS
01	Air Vehicle	Pounds	Weight - Static Dry
		Pounds	Weight - Static Wet
		Pounds	Weight - Max Takeoff
		Pounds	Weight - Max Landing
		Inches	Length
		Inches	Span - Static
		Inches	Span - Transonic
		Inches	Span - Supersonic
		None	Aspect Ratio - Static
		Inches	Height - Static
		Pounds	Payload
		Mach No.	Speed - Max
		Mach No.	Speed - Cruise
		KIAS	Speed - Max Weight Takeoff
		KIAS	Speed - Max Weight Landing
		KIAS	Speed - Normal Landing Weight
		Pounds/Ft <sup>2</sup>	"Q" - Max Air Loads
		Feet	Altitude - Max Design
		Feet	Altitude - Mean Cruise
		Degrees F	Temperature - OPS Range
		Feet/Sec <sup>2</sup>	"G" - Design OPS Range
		Feet	Distance - Max Weight Landing
		Feet	Distance - Normal Wt Landing
		None	L/D
		N Miles	Range
		Pounds	Thrust - Static Idle
		Pounds	Thrust - Static Military
		Pounds	Thrust - Static Max
		Type/No.	Engines
0101	Airframe Structure	Pounds	Weight
		Type	Construction
		Type	Materials
		Inches	Length
		Inches	Span
		None	Aspect Ratio
		Feet/Sec <sup>2</sup>	"G" - Design Loads



WBS CODE	TITLE	UNITS	CHARACTERISTICS
0101	Airframe Structure (Cont)	Pounds/Ft <sup>2</sup> Degrees F Type/No. Type/No. Type	"Q" - Design Air Loads Temperature - Design Range Access Points Major Assemblies Joining Major Assemblies
010101	Horizontal Stab. & Flaps	Pounds Type Type Type Inches Inches Feet <sup>2</sup> None Degrees Degrees F Pounds/Ft <sup>2</sup> Type/No. Type/No. Type	Weight Horizontal Stabilizer Structure Materials Span MAC Area Location Travel Temperature - Design Range Loads - Design Access Points Major Assemblies Joining Major Assemblies
010102	Wing Structure	Pounds Type Type Type Inches Inches Feet <sup>2</sup> Degrees F Pounds/Ft <sup>2</sup> Type/No. Type/No. Type Type/No. Feet <sup>2</sup> Type/No. Degrees Degrees	Weight Construction Structure Materials Span MAC Area Temperature - Design Range Loads - Design Access Points Major Assemblies Joining Major Assemblies Fuel Tanks Folded Area Control Surfaces Wing Tip Fold Elevon Travel
010103	Vertical Stab. Structure	Pounds Type/No. Type Inches	Weight Type/No. of Verticals Structure/Materials Span



WBS CODE	TITLE	UNITS	CHARACTERISTICS
010103	Vert Stab. Struct (Cont)	Inches Feet <sup>2</sup> Degrees F Pounds/Ft <sup>2</sup> Type/No. Degrees Degrees	MAC Area Temperature - Design Range Design Loads Access Points Travel - Gear Down Travel - Gear Up
010104	Forward Fuselage	Pounds Type Type Inches Inches Inches Degrees F Pounds/Ft <sup>2</sup> Type/No. Type/No. Type Type/No.	Weight Construction Structure/Materials Length Height Width Temperature - Design Range Design Loads Access Points Major Assemblies Joining Major Assemblies Major Compartments
010105	Intermediate Fuselage	Pounds Type Type Inches Inches Inches Degrees F Pounds/Ft <sup>2</sup> Type/No. Type/No. Type Type/No. Type/No. Type/No.	Weight Construction Structure/Materials Length Height Width Temperature - Design Range Design Loads Access Points Major Assemblies Joining Major Assemblies Major Compartments Fuel Tanks Control Surfaces
010106	Aft Fuselage	Pounds Type Type Inches Inches Inches Degrees F	Weight Construction Structure/Materials Length Height Width Temperature - Design Range



WBS CODE	TITLE	UNITS	CHARACTERISTICS
010106	Aft Fuselage (Cont)	Pounds/Ft Type/No. Type/No. Type Type/No. Type/No. Type/No.	Design Loads Access Points Major Assemblies Joining Major Assemblies Major Compartments Fuel Tanks Control Surfaces
010107	Ground Tests	Number Type/No. Type/No. Type/No. Type/No. Pounds Type % of FS PSI PSI, PSF PSI, "G's" Pounds/Foot Hertz, db Hertz, "G's" Degrees F Days, Hr, Sec	Total Specimens Major Assemblies Models Tests Facilities Weight Range Measurements (Data) Accuracy (Data) Internal Pressure Levels External Pressure Levels Static Load Levels Torque Load Levels Acoustic Environmental Levels Vibration & Flutter Levels Temperature Ranges Time
0102	ECS	Pounds Type/No Type Type Type Degrees F Type Number PSI PSI Pounds/Hr Type/No.	Weight (Wet Total) Major Subsystems Materials Fluids Gases Temperature - Design Range Heat Sinks Number of Crew Members Fluids Working Pressure Gases Working Pressure Flow Rates Heat Exchangers
010201	Cabin Air Recirculation	Pounds Type/Lb Type/Lb Degrees F Type	Weight (Wet Total) Fluid Mediums/Weight Gaseous Mediums/Weight Temperature - DES Range Heat Sinks



WBS CODE	TITLE	UNITS	CHARACTERISTICS
010201	A/F Structure (Cont)	Type/No. PSI PSI Pounds/Hr BTU/Hr Type/No. Feet <sup>3</sup> Type Number None No. of Hr	Heat Exchangers Fluid Working Pressure Gases Working Pressure Flow Rates Heat Load Rejections Compartments Compartment Volumes Functional Modes Number of Crew Members Reliability Factor MTBF
010202	Water Supply	Pounds Pounds PSI PSI Degrees F Type/No. BTU/Hr Pounds/Hr None No. of Hr	Weight (Wet Total) Water Volume Static Head Pressure Medium Working Pressure Temperature - Design Range Heat Exchangers Heat Load Rejection - Max Flow Rate - Max Reliability Factor MTBF
010203	Ammonia Supply	Pounds Pounds PSI PSI Degrees F Type/No. BTU/Hr Pounds/Hr None No. of Hr	Weight (Wet Total) Ammonia Volume Static Back Pressure Medium Working Pressure Temperature - Design Range Heat Exchangers Heat Load Rejection Flow Rate - Max Reliability Factor MTBF
010204	Secondary Pressurization	Pounds Type/No. Feet <sup>3</sup> PSI PSI Degrees F Pounds/Hr Type BTU/Hr	Weight Compartments Compartment Volumes Supply Pressure Medium Working Pressure Temperature - Design Range Heat Exchangers Heat Sinks Heat Load Rejection



WBS CODE	TITLE	UNITS	CHARACTERISTICS
010204	Sec Press. (Cont)	Type Number None No. of Hr	Functional Modes Number of Crew Members Reliability Factor MTBF
010205	Eng Inlet Fuel Cooling	Pounds Type Type/No. PSI Pounds/Hr BTU/Hr None No. of Hr	Weight Heat Sink Heat Exchanger Medium Design Pressure Medium Flow Rate Heat Load Rejection - Max Reliability Factor MTBF
010206	W/S Air Gap Filter/Drying	Pounds Type/No. Type/No. Degrees F % Volume None No. of Hr	Weight Filters Desiccants Temperature - Design Range Humidity Control Reliability Factor MTBF
010207	Eng Extraction Air	Pounds PSI Pounds/Hr Degrees F Type Type/No. BTU/Hr None No. of Hr	Weight Air Extraction Pressure - Max Air Flow - Max Design Temperature - Design Range Heat Sink Heat Exchangers Heat Ejection Reliability Factor MTBF
010208	Recirc Liquid Cooling	Pounds Pounds Degrees F PSI PSI Type BTU/Nr Type Pounds/Hr None No. of Hr	Weight (Wet Total) W/g Volume Temperature - Design Range Static Pressure Head Medium Working Pressure Heat Exchangers Heat Ejection - Max Heat Sink Flow Rate Reliability Factor MTBF



WBS CODE	TITLE	UNITS	CHARACTERISTICS
010209	Remote Equip. Cooling	Pounds	Weight (Wet Total)
		Type	Cooling Medium
		Pounds	Cooling Medium Volume
		PSI	Static Pressure Head
		PSI	Medium Working Pressure
		Type	Heat Exchanger
		BTU/Hr	Heat Ejection - Max
		Type	Heat Sink
		Pounds/Hr	Flow Rate
		Degrees F	Temperature - Design Range
		Type	Compartments
		Feet <sup>3</sup>	Compartment Volume
		None	Reliability Factor
		No. of Hr	MTBF
010210	Rain Removal/Defogging	Pounds	Weight
		Type	Operational Medium
		PSI	Operational Pressure
		Pounds/Nr	Flow Rate
		Watts	Power
		Degrees F	Temperature - Design Range
		None	Reliability Factor
		No. of Hr	MTBF
010211	Ground Tests	Number	Total Specimens
		Type/No.	Major Assemblies
		Type/No.	Models
		Type/No.	Tests
		Type/No.	Facilities
		Type	Measurements (Data)
		% of FS	Accuracy (Data)
		Hertz	Frequency Response (Data)
		% of FS	Resolution (Data)
		PSI	Internal Pressure Levels
		PSI	External Pressure Levels
		Degrees F	Temperature Ranges
		Type	Heat TRansports
		Days,Hr,Sec	Time



WBS CODE	TITLE	UNITS	CHARACTERISTICS
0103	Propulsion	Type/No.	Major Subsystems
		Pounds	Weight
		Pounds	Thrust - Static Idle
		Pounds	Thrust - Static Military
		Pounds	Thrust - Static Max
		Type/No.	Engines
		Feet <sup>3</sup> /Min	Air Flow Volume (Max)
		Type	Fuel
		Pounds/Gal	Fuel Specific Weight
		Lb/Hr/Lb	Specific Fuel Consumption
		BTU/Lb	Specific Internal Energy
		RPM	Engine Speed (100%)
		PSI	Internal Pressure
		Hr,Min	Time - Limiting
		Hours	Operational Life
		None	Reliability Factor
		No. of Hr	MTBF
010301	Engines	Type	Engine
		Pounds	Weight
		Pounds	Rated Thrust
		Ft-Lb/Min	Horsepower
		None	Compression Ratio
		Inches	Length
		Inches	Diameter
		Ft-Lb/Min	Horsepower Extracted
		RPM	Engine Speed
		Feet <sup>3</sup> /Min	Air Flow Volume (Max)
		None	Fuel Air Ratio (Static Max)
		Lb/Hr/Lb	Specific Fuel Consumption
		BTU/Lb	Specific Internal Energy
		PSI	Internal Pressures
		Type	Exhaust Section
		None	Nozzle Coefficient
		Inch-Lb	Torque (Max)
		Degrees R	Gas Temperature
		Degrees F	Structure Temperature
		Type	Lube Medium
		Type	Control Power Medium
		Mach No.	Air Speed - Max Design
		Feet	Altitude - Max Design



WBS CODE	TITLE	UNITS	CHARACTERISTICS
010302	Engine Installation	Pounds	Weight
		Type/No.	Compartments
		Type	Structure/Material
		Type/No.	Access Points
		Degrees F	Temperature - Design Range
		Type	Mounting Installations
		Type/No.	Fluid Drains
		None	Reliability Factor
		No. of Hr	MTBF
010303	Engine Compt Cooling	Pounds	Weight
		Type/No.	Compartments
		Type	Structure/Material
		Type	Control Medium
		Degrees F	Temperature - Design Range
		Pounds/Hr	Air Flows
		PSI	Internal Pressure
		KIAS/Mach	Air Speed - Max Design
		Feet	Altitude - Max Design
		None	Reliability Factor
		No. of Hr	MTBF
010304	Gaseous Nitrogen Supply	Pounds	Weight
		Type	Installation
		Type/No.	Tanks
		PSI	Pressure - Max Design
		PSI	Pressure - Subsystem Supplies
		Degrees F	Temperature - Design Range
		Pounds/Hr	Flow Rates - Max
		None	Reliability Factor
		No. of Hr	MTBF
010305	Fuel System	Pounds	Weight
		Gallons	Volume
		Type	Fuel
		Pounds/Gal	Specific Weight
		BTU/Lb	Specific Energy
		Degrees F	Flash Point
		Type	Inerting Medium
		Pounds/Hr	Flow Rate
		PSI	Supply Pressure
		Type/No.	Heat Exchangers
		BTU	Heat Absorbed





WBS CODE	TITLE	UNITS	CHARACTERISTICS
010305	Fuel System (Cont)	Type/No.	Filtration
		GPM	Refueling Rate
		Type/No.	Tanks
		Type/No.	Pumps
		Type/No.	Fuel Weight Gaging
		Type	CG Control
		None	Reliability Factor
		No. of Hr	MTBF
010306	Engine Thrust Control	Pounds	Weight
		Type/No.	Controls
		Type	Control Communications
		Type/No.	Modes of Operation
		None	Reliability Factor
		No. of Hr	MTBF
010307	Engine Indicating System	Type/No.	Indications
		Pounds	Weight
		% of FS	Accuracy
		Hertz	Frequency Response
		% of FS	Resolution
		% of FS	Hysteresis
		% of FS	Linearity
		Degrees F	Temperature - Design Range
		None	Reliability Factor
		No. of Hr	MTBF
010308	Ground Tests	Type/No.	Major Assemblies
		Type/No.	Models
		Type/No.	Tests
		Type/No.	Facilities
		Type	Measurements (Data)
		% of FS	Accuracy (Data)
		Hertz	Frequency Response (Data)
		% of FS	Resolution (Data)
		PSI	Pressure Ranges
		Degrees F	Temperature Ranges
		HP	Mechanical Power Levels
		GPM,Lb/Min	Fluid Flow Levels
		Days,Hr,Sec	Time



WBS CODE	TITLE	UNITS	CHARACTERISTICS
0104	Secondary Power Subsystem	Pounds	Weight (Total)
		Type	Major Subsystems
		Watts	Total Elec Power Available
		Watts	Max Elec Power Continuous
		Watts	Normal Elec Power Level
		HP	Max Installed Hydraulic Power
		HP	Normal Hydraulic Power Level
		Specify	Electrical Source
		Specify	Hydraulic Power Source
		Specify	Ground Start Power
		Degrees F	Temperature - Design Range
		Type	Heat Sinks
		PSI	Fluid Working Pressure
		Volts	Electrical Force Level
		None	Reliability Factor
010401	Hydraulic Power Supply	Pounds	Weight (Total)
		Type	Hydraulic Fluid
		Gallons	Hydraulic Fluid Capacity
		HP	Max Installed Power
		HP	Normal Power Level
		Degrees F	Temperature - Design Range
		Type/No.	Hydraulic Systems
		Type/No.	Pumps
		Type/No.	Filters
		Type/No.	Heat Exchangers
		PSI	Pressure Levels
		GPM	Flow Rates
		Type	Inerting Medium
		PSI	Inerting Pressure Level
		Type	Deaeration
		Type	Hydraulic Distribution Lines
		Number	Subsystems Supplied
		None	Reliability Factor
		No. of Hr	MTBF
010402	Accessory Drive System	Pounds	Weight
		Number	Gear Boxes
		HP	Power Input - Max
		RPM	Speed Input Range
		Type	Cooling/Lube Fluid
		Type	Heat Sink
		Type/No.	Heat Exchangers



WBS CODE	TITLE	UNITS	CHARACTERISTICS
010402	Access. Dr Sys (Cont)	Degrees F Type/No. Type/No. Type PSI Type None No. of Hr	Temperature - Design Range Pumps Reservoirs Inerting Medium Inerting Pressure Level Speed Control Reliability Factor MTBF
010403	Ground Starting System	Pounds Specify HP Type Ft-Lb None No. of Hr	Weight Power Source Power Input Power Translation Torque Transmitted Reliability Factor MTBF
010404	Constant Speed Drive	Pounds Number Type Type Type Degrees F RPM RPM HP HP None No. of Hr	Weight Installations Speed Control Fluid Medium Heat Sink Temperature - Design Range Speed Input - Range Speed Output Power Output - Max Power Output - Normal Reliability Factor MTBF
010405	Electrical Power Supply	Pounds Watts Watts Watts Amperes Volts Number Hertz Type/No. Type/No. Type/No. Specify Type	Weight Power - Max Available Power - Max Continuous Power - Normal Level Current - Max Design Force Level - Max Design Power Phases Frequency Generators Rectifiers Busses Feeder Lines Fault Protection



WBS CODE	TITLE	UNITS	CHARACTERISTICS
010405	Elec Pwr Sup (Cont)	Specify Type Degrees F Specify None No. of Hr	Auxiliary Power Wiring Provisions Temperature - Design Range Ground Power Source Reliability Factor MTBF
010406	Ground Tests	Type/No. Type/No. Type/No. Type % of FS Hertz % of FS PSI Watts Degrees F GPM Amperes Volts Ohms HP Days,Hr,Sec	Models/Mockups/Breadboards Facilities Tests Measurements (Data) Accuracy (Data) Frequency Response (Data) Resolution (Data) Fluid Pressure Range Electrical Power Range Temperature Range Fluid Flow Range Electrical Current Levels Electrical Force Levels Electrical Resistance Levels Mechanical Power Levels Time
0105	Air Induction Subsystem	Pounds Type/No. Specify Degrees F Mach No. Feet Percent Percent Specify Specify Specify Type None No. of Hr	Weight Major Subsystems Power Source Temperature - Design Range Speed - Design Range Altitude - Max Design Pressure Recovery - Static Pressure Recovery - Cruise Shock Patterns Operational Modes Functional Protection Heat Sink Reliability Factor MTBF
010501	Inlet Subsystem	Pounds Number Inches <sup>2</sup> Type/No.	Weight Engines per Inlet Capture Area Ramps

WBS CODE	TITLE	UNITS	CHARACTERISTICS
010501	Inlet Subsys (Cont)	Type	Seals (Aerodynamic)
		Inches	Length
		Inches	Height
		Inches	Width (Static)
		Inches <sup>2</sup>	Throat Area Variation
		Type	Actuation Power
		Mach No.	Speed - Design Range
		Feet	Altitude - Max Design
		Percent	Pressure Recovery - Static
		Percent	Pressure Recovery - Cruise
		Specify	Shock Patterns
		Type	Heat Sink
		None	Reliability Factor
		No. of Hr	MTBF
010502	Bypass Subsystem	Pounds	Weight
		Inches <sup>2</sup>	Exhaust Area - Max
		Type/No.	Doors
		Inches	Door Length
		Inches	Door Width
		Type	Seals (Aerodynamic)
		Type	Actuation Power
		Mach No.	Speed - Design Range
		Feet	Altitude - Max Design
		Type	Heat Sink
		None	Reliability Factor
		No. of Hr	MTBF
010503	Air Induction Cont Subsys	Pounds	Weight
		Type/No.	Sensors
		Type/No.	Control Modes
		Type/No.	Override Functions
		Mach No.	Speed - Design Range
		Feet	Altitude - Max Design
		Specify	Control Power
		Type/No.	Control Parameters
		Inches <sup>2</sup>	Accuracy
		Hertz	Frequency Response
		Inches <sup>2</sup>	Resolution
		Degrees F	Temperature - Design Range
		Type	Heat Sink
		None	Reliability Factor
		No. of Hr	MTBF



WBS CODE	TITLE	UNITS	CHARACTERISTICS
010504	Controls & Displays	Pounds	Weight
		Number	Indicators
		Number	Functional Lights
		Number	Mode Switches
		Number	Manual Controls
		% of FS	Indicator Accuracies
		% of FS	Indicator Resolutions
		Hertz	Indicator Frequency Response
		Inches <sup>2</sup>	Manual Accuracies
		Inches <sup>2</sup>	Manual Resolutions
		Degrees F	Temperature - Design Range
		None	Reliability Factor
		No. of Nr	MTBF
010505	Boundary Layer Control	Pounds	Weight
		Number	Number of Chambers
		Number	Bleed Panels
		Specify	External Control
		PSI	Pressure
		Degrees F	Temperature - Design Range
		Mach No.	Speed - Design Range
		Feet	Altitude - Max Design
		Type	Seals (Aerodynamic)
		None	Reliability Factor
		No. of Hr	MTBF
010506	Ground Tests	Type/No.	Major Assemblies
		Type/No.	Models
		Type/No.	Mockups
		Type/No.	Facilities
		Type/No.	Tests
		Type	Measurements (Data)
		% of FS	Accuracy (Data)
		Hertz	Frequency Response (Data)
		% of FS	Resolution (Data)
		PSI	Pressure Ranges
		Pounds/Ft <sup>2</sup>	Air Loads (Q) Ranges
		Mach No.	Speed Ranges
		Degrees	Angular Displacements
		Degrees F	Temperature Ranges
		Days, Hr, Sec	Time



WBS CODE	TITLE	UNITS	CHARACTERISTICS
0106	Fire Protection Subsystem	Pounds Type/No. Specify Degrees F Mach No. Feet None No. of Hr	Weight (Wet Total) Major Subsystems Power Source Temperature - Design Range Speed - Design Range Altitude - Max Design Reliability Factor MTBF
010601	Fire Detection Subsystem	Pounds Number Feet Inches Degrees F Mach No. Feet Amps, Volts Type Type Number None No. of Hr	Weight Number of Compartments Length Diameter Temperature - Design Range Speed - Design Range Altitude - Max Design Power Required Sensing Cables Sensing Rings Display Lights Reliability Factor MTBF
010602	Fire Extinguishing	Pounds Number Type Pounds Number Seconds Type.No. PSI Feet <sup>3</sup> None No. of Hr	Weight (Wet Total) Number of Compartments Chemical Agent Volume of Agent Number of Agent Discharges Discharge Time Tank Tank Pressure Compartment Volume Reliability Factor MTBF
010603	Eng Compt Cool. Interlock	Type/No. Specify Degrees F PSI None No. of Hr	Controls Functional Modes Temperature - Design Range Pressure - Max Design Reliability Factor MTBF



WBS CODE	TITLE	UNITS	CHARACTERISTICS
010604	Fuel Shut-Off Interlock	Type/No. Specify Degrees F None No. of Hr	Controls Functional Modes Temperature - Design Range Reliability Factor MTBF
010605	Ground Tests	Type/No. Type/No. Type/No. Type/No. Type/No. Type % of FS PSI Feet <sup>3</sup> /Min Degrees F Days,Hr,Sec	Major Assemblies Models Mockups Facilities Tests Measurements (Data) Resolution (Data) Pressure Ranges Air Flow Ranges Temperature Ranges Time
0107	Flight Control Subsystem	Pounds Type/No. Specify Degrees F Mach No. Feet Pounds/Ft <sup>2</sup> None No. of Hr	Weight Major Subsystems Power Source Temperature - Design Range Speed - Max Design Altitude - Max Design Air Loads (Q) - Max Design Reliability Factor MTBF
010701	Primary Flight Control	Pounds Number Type Type Type Type Type Degrees Degrees Type Type Feet Inches Type/No. Feet <sup>2</sup>	Weight Crew Control Stations Crew Lateral Control Crew Longitudinal Control Crew Yaw Control Feel Force "G" Gradient Force Wheel Travel Column Travle Primary Control Transmission Back-up Control Transmission Cable Length Cable Diameter Control Surfaces Control Surface Areas





WBS CODE	TITLE	UNITS	CHARACTERISTICS
010701	PFC (Cont)	Degrees	Rudder Travel (Gear Down)
		Degrees	Rudder Travel (Gear Up)
		Specify	Power Source
		Degrees/Sec	Max Travel Rate - Pitch
		Degrees/Sec	Max Travel Rate - Roll
		Degrees/Sec	Max Travel Rate - Yaw
		Degrees F	Temperature - Design Range
		Type/No.	Actuators
		Type	Actuator Seals
		PSI	Actuator Working Pressure
		GPM	Hyd Flow Required - Design Max
		Amps,Volts	Elec Pwr Required - Design Max
		None	Reliability Factor
		No. of Hr	MTBF
010702	Secondary Flight Control	Pounds	Weight
		Number	Crew Control Stations
		Degrees	Elevon Trim Travel - Pitch
		Degrees	Elevon Trim Travel - Diff
		Degrees	Stand-By Trim Travel
		Type/No.	Pitch Trim Motors
		Type/No.	Roll Trim Motors
		Degrees	Yaw Trim Travel
		Type/No.	Yaw Trim Motor
		Type/No.	Trim Actuators
		PSI	Actuator Working Pressure
		Amps,Volts	Pitch Trim Elec Power Required
		Amps,Volts	Roll Trim Elec Power Required
		Amps,Volts	Yaw Trim Elec Power Required
		GPM	Pitch Trim Max Hydraulic Flow
		GPM	Roll Trim Max Hydraulic Flow
		GPM	Yaw Trim Max Hydraulic Flow
		Type	Trim Signal Transmission
		Degrees F	Temperature - Design Range
		Type/No.	Flaps Position Motor
		Amps,Volts	Flap Pos Motor Elec Power Req'd
		Degrees	Flap Position Travel
		Type/No.	Flap Actuator
		Type/No.	Trim Position Sensors
		Degrees	Wing-Tip Fold Travel - Max
		Degrees	Wing-Tip Fold Travel - Intermed
		Type/No.	Wing-Tip Fold Actuator
		None	Wing-Tip Fold Gearing Ratio

WBS CODE	TITLE	UNITS	CHARACTERISTICS
010702	Sec Flt Cont (Cont)	Type/No.	Wing-Tip Fold Pos Sensors
		PSI	Hyd Press. - Wing-Tip Fold
		Degrees	Elevon Trim Resolution - T.O.
		Degrees	Roll Trim Centering - T.O.
		Degrees	Yaw Trim Centering - T.O.
		Degrees	Horiz Stab. Resolution - T.O.
		Type	Trim for Takeoff Control
		Type/No.	Pitch Trim Controls
		Type/No.	Roll Trim Controls
		Type/No.	Yaw Trim Controls
		None	Reliability Factor
		No. of Hr	MTBF
010703	Flight Augmentation	Pounds	Weight
	Control Subsys (FACS)	Number	Crew Control Stations
		Type/No.	Control Parameters
		Hertz	Frequency Response - Pitch
		Hertz	Frequency Response - Roll
		Hertz	Frequency Response - Yaw
		Type/No.	Pitch Servo
		Type/No.	Roll Servo
		Type/No.	Yaw Servo
		Type	Power Source
		GPM	Hydraulic Flow Demand - Max
		Amps,Volts	Elec Power Demand - Max
		Type/No.	Normal Accelerometer
		Hertz	Normal Accel Freq Response
		Feet/Sec <sup>2</sup>	Normal Acceleration Range
		Type	Pitch Rate Gyro
		Hertz	Pitch Rate Gyro Freq Response
		% of FS	Pitch Rate Gyro Hysteresis
		% of FS	Pitch Rate Gyro Linearity
		Type	Roll Rate Gyro
		Hertz	Roll Rate Gyro Freq Response
		% of FS	Roll Rate Gyro Hysteresis
		% of FS	Roll Rate Gyro Linearity
		Type	Yaw Rate Gyro
		Hertz	Yaw Rate Gyro Freq Response
		% of FS	Yaw Rate Gyro Hysteresis
		% of FS	Yaw Rate Gyro Linearity
		Degrees/Sec	Pitch Max Rate Limiting
		Degrees/Sec	Roll Max Rate Limiting
		Degrees/Sec	Yaw Max Rate Limiting



WBS CODE	TITLE	UNITS	CHARACTERISTICS
010703	FACS (Cont)	Degrees	Pitch Max Displacement
		Degrees	Roll Max Displacement
		Degrees	Yaw Max Displacement
		Type/No.	Linear Displacement Xducers
		Type/No.	Linear Guarded Xducers
		Type/No.	Rotary Pitch Trim Xducers
		Number	Number of Displays
		Number	Number of Controls
		Type	Emergency Disengage
		None	Reliability Factor
		No. of Hr	MTBF
010704	Ground Tests	Type/No.	Major Assemblies
		Type/No.	Mockups/Breadborads
		Type/No.	Models
		Type/No.	Test Beds
		Type/No.	Tests
		Type	Measurements (Data)
		% of FS	Accuracy (Data)
		Hertz	Frequency Response (Data)
		% of FS	Resolution (Data)
		M,KIAS	Speed Test Range
		Feet	Altitude Test Range
		Degrees F	Temperature Test Range
		Hertz	Dynamic Input Test Range
		Feet/Sec <sup>2</sup>	Acceleration Input Test Range
		Days,Hr,Sec	Time
0108	Pers Accom & Esc Subsys	Pounds	Weight
		Specify	Major Subsystems
		Number	Number of Crew Stations
		Degrees F	A/V Ambient Temp - Dsgn Range
		Degrees F	Crew Ambient Tem- - Dsgn Range
		Feet <sup>3</sup>	Crew Compartment Volume
		Number	Number of System Indicators
		Number	Number of Event Displays
		Number	Number of System Controls
		Number	Number of Toggle Switches
		Number	Number of Push Buttons
		Number	Number of Selector Switches
		Number	Number of Circuit Breakers
		Number	Number of C&W Lights
		Feet	Minimum Ejection Altitude



WBS CODE	TITLE	UNITS	CHARACTERISTICS
0108	Pers Accom & Esc Subsys (Cont)	KIAS Feet Mach No. None No. of Hr	Minimum Ejection Speed Max Ejection Altitude Max Ejection Speed Reliability Factor MTBF
010801	Personnel Equipment	Pounds Number Type Type Type Type	Weight Number of Crew Members Crew Helmet Crew Oxygen Mask Flight Suit Pressure Suit
010802	Liquid Oxygen Subsystem	Pounds Pounds Type Specify Type Type PSI Type Degrees F Pounds PSI Type PSI None No. of Hr	Weight LOX Quantity LOX Converter Heat Sink Heat Exchanger LOX Supply Regulators LOX Supply Pressure LOX Filtration LOX Supply Temperature Portable LOX Quantity Portable LOX Pressure Portable LOX Press Regulator Pressure Suit Regulation Reliability Factor MTBF
010803	Crew Sta Accommodations	Pounds Number Feet <sup>3</sup> Number Number Number Number Number Number Number Inches Inches Type Decibels	Weight Number of Crew Stations Crew Compartment Volume Number of Indicators Number of Event Displays Number of Controls Number of Switches Number of Push Buttons Number of Circuit Breakers Number of C&W Lights Seat Adjustment - Vertical Seat Adjustment - Fore & Aft Noise Suppression Noise Level - Takeoff



WBS CODE	TITLE	UNITS	CHARACTERISTICS
010803	Crew Sta Accommodations (Cont)	Decibels Decibels Specify None No. of Hr	Noise Level - Landing Noise Level - Cruise Ground Escape Reliability Factor MTBF
010804	Escape Subsystem	Pounds Number Inches Type Type/No. Pounds Seconds Type/No. KIAS Feet Mach No. Feet Pounds Type Pounds Type Pounds/Sec Feet/Sec <sup>2</sup> Type/No. Pounds Type/No. Type/No. Feet Types Type Type Pounds Type Type/No. Type Type Feet/Sec <sup>2</sup> Type Foot-Lb Type Pounds Number	Weight Number of Capsules Length, Width, Height Encapsulation Controls Rotary Thrusters Rotary Thruster Thrust Encapsulation Time Encapsulation Initiators Minimum Ejection Speed Minimum Ejection Altitude Maximum Ejection Speed Maximum Ejection Altitude Lift or Carry Weight Rocket Catapult Catapult Thrust Level Rocket Propellant Total Impulse - Catapult Acceleration - Catapult Boom Thrusters Boom Thruster Thrust Stabilizer Chutes Main Parachutes Main Chute Deployment Altitude Main Chute Release Hatch Initiators Hatch Boosters Hatch Booster Thrust Hatch Removers Gas Generators Sequence Valving Impact Attenuators Normal Impact Loads Restraint Harness Inertial Reel Torque Control Column Thruster Control Column Thruster Thrust Number Stowed Survival Kits



WBS CODE	TITLE	UNITS	CHARACTERISTICS
010804	Escape Subsys (Cont)	Type	Stowed Survival Radio
		Type	Stowed Radar Aid
		None	Reliability Factor
		Days	Stowed Life
010805	Aft Escape Hatch	Pounds	Weight
		Number	Number of Hatches
		Type/No.	Hatch Initiators
		Type	Hatch Booster
		Pounds	Booster Thrust
		Type	Hatch Remover
		Specify	Hatch Ejection Controls
		None	Reliability Factor
		Days	Stowed Life
010806	Development Tests	Type/No.	Major Assemblies
		Type/No.	Mockups
		Type/No.	Models
		Type/No.	Test Beds
		Type/No.	Test Sleds
		Type/No.	Facilities
		Type/No.	Tests
		Type	Measurements (Data)
		% of FS	Accuracy (Data)
		Hertz	Frequency Response (Data)
		% of FS	Resolution (Data)
		M,KIAS	Speed Test Range
		Feet	Altitude Test Range
		Degrees F	Temperature Test Range
		Pounds/Ft <sup>2</sup>	Air Loads
0109	Alighting & Arresting Sys	Type/No.	Major Subsystems
		Pounds	Weight
		Type	Alighting Gear
		Pounds	Max Support Weight - Static
		Pounds	Max Support Weight - Takeoff
		Pounds	Max Support Weight - Landing
		Type/No.	Brakes
		Foot-Lb	Max Brake Energy Capacity
		Type/No.	Drag Chutes
		KIAS	Max Speed - Drag Chute Deploy
		KIAS	Min Speed - Drag Chute Deploy



WBS CODE	TITLE	UNITS	CHARACTERISTICS
0109	Alighting & Arresting Sys (Cont)	Pounds None No. of Hr	Max Drag Chute Drag Reliability Factor MTBF
010901	Main Landing Gear	Pounds Type/No. Pounds Type/No. PSI Number Inches Type/No. Inches Specify Type/No. Number Number Specify Foot-Lb Specify Type/No. Hertz Type/No. Hertz Type Type Type Type Hertz Hertz % of FS % of FS Inches Inches Degrees F Type Type Type PSI Type Degrees Degrees Type	Weight Main Gear Structure Max Support Weight (Static) Tires Tire Pressure (Max Weight) No. of Thermal Cycles - Tires Tire Size Wheel Wheel Size Wheel Arrangement Brakes Number of Disks Number of Stators Lining Material Max Brake Energy Capacity Brake Control Brake Control Parameters Brake Control Freq Response Brake Actuators Brake Actuators Freq Response Brake Torque Sensor Brake Wheel Speed Sensor Brake Ref Wheel Speed Sensor Brake Temperature Sensor Wheel Speed Sensors Freq Resp Torque Sensor Freq Response Wheel Speed Sensors Hysteresis Torque Sensor Hysteresis Reference Wheel Size Reference Wheel Tire Size Temperature - Design Range Bogie Beam Structure Bogie Rotate Actuator Bogie Rotate Actuator Seals Bogie Rotate Actr Hyd Press. Bogie Fold & Pitch Actuator Bogie Rotate Travel Bogie Fold Travel Main Gear Shock Strut



WBS CODE	TITLE	UNITS	CHARACTERISTICS
010901	Main Landing Gear (Cont)	Inches	Shock Strut Max Travel
		PSI	Shock Strut Press. - Max Wt
		Type/No.	Shock Strut Seals
		Type/No.	Shock Strut Actuators
		Type	Shock Strut Actuator Seals
		Type	Main Gear Door Actuators
		Type/No.	Main Gear Door Locks
		Type/No.	Main Gear Locks
		Type	Main Gear Sequencing
		None	Reliability Factor
		No. of Nr	MTBF
010902	Nose Gear	Pounds	Weight
		Pounds	Max Support Weight (Static)
		Type/No.	Tires
		PSI	Tire Pressure (Max Weight)
		Number	No. of Thermal Cycles - Tires
		Inches	Tire Size
		Type/No.	Wheel
		Inches	Wheel Size
		Type	Shock Strut
		Inches	Shock Strut Max Travel
		PSI	Shock Strut Press. - Max Wt
		Type	Shock Strut Seals
		Type/No.	Strut Actuators
		Type	Strut Actuator Seals
		Type	Nose Gear Steering
		Type	Steering Actuation
		Type	Steering Pos Output Xducer
		Type	Steering Pos Input Xducer
		Hertz	Steering Frequency Response
		% of FS	Steering System Hysteresis
		Degrees	Nose Gear Steering Travel
		None	Reliability Factor
		No. of Hr	MTBF
		Degrees F	Temperature - Design Range
		Type	Nose Gear Structure
010903	Drag Chute Subsystem	Pounds	Weight
		Type/No.	Drag Chutes
		KIAS	Max Speed Drag Chute Deploy
		KIAS	Min Speed Drag Chute Deploy
		Pounds	Max Design Drag Load





WBS CODE	TITLE	UNITS	CHARACTERISTICS
010903	Drag Chute Subsystem (Cont)	Type Type Type Type None No. of Hr	Compartment Door Actuation Chute Cable Locking Mechanism Chute Cable Release Mechanism Hook Lock Actuator Reliability Factor MTBF
010904	Controls & Displays	Pounds Number Number Number Number Number Number Number None No. of Hr	Weight Number of Indicators Number of Controls Number of Event Displays Number of Gear Control Modes Number of Brake Control Modes No. of Drag Chute Control Modes Number of C&D Lights Reliability Factor MTBF
010905	Ground Tests	Type/No. Type/No. Type/No. Type/No. Type/No. Type % of FS Hertz % of FS % of FS Foot-Lb Degrees F PSI Hertz Feet/Sec <sup>2</sup> Days,Hr,Sec	Major Assemblies Mockups/Breadboards Models Facilities Tests Measurements (Data) Accuracy (Data) Frequency Response (Data) Resolution (Data) Hysteresis (Data) Energy Level - Max Temperature Range Pressure Level Range Dynamic Cycle Range G Loading Range Time
0110	Mission & Traffic Control	Pounds Specify Type/No. Number Type Number Specify Specify	Weight Major Subsystems Command Radio Number of Command Channels Intercom Set No. of Intercom Grd Stations ILS Group TACAN



WBS CODE	TITLE	UNITS	CHARACTERISTICS
0110	Mission & Traffic Control (Cont)	Specify Specify Number Watts Hertz Watts Hertz Number None No. of Hr	IFF Equipment Portable Tape Recorder Number of Crew Stations Command Radio Power Output Command Radio Freq Spectrum IFF Power Output IFF Frequency Spectrum Number of IFF Modes Reliability Factor MTBF
011001	Communication Equipment	Pounds Type/No. Hertz Number Watts Watts Watts Percent Percent Microvolts Percent Type/No. Specify None Type Decibel Decibel Decibel Decibel Type Watts None Number None No. of Hr	Weight Command Radios Radio Frequency Spectrum Number of Command Channels Power Output Transmitter Power Output Transmitter Power Input Modulation Level Transmitter Efficiency Receiver Sensitivity Power Supply Regulation Antennas Antenna Pattern Standing Wave Ratio Lobe Switching System Linearity System Response System Susceptibility System Noise Level Intercommunication Set Intercom Power Output Intercom Signal/Noise Ratio Intercom Ground Stations Reliability Factor MTBF
011002	Navigational Aids Equip.	Pounds Type Watts Type Hertz Microvolts	Weight TACAN TACAN Transmitter Power Output TACAN Transmission Signal TACAN Xmsn Sig Freq Spectrum TACAN Receiver Sensitivity

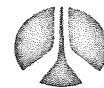
WBS CODE	TITLE	UNITS	CHARACTERISTICS
011002	Navigation Aids Equip. (Cont)	Hertz Number Megahertz Specify Type/No. Hertz Hertz None Type Number Hertz Hertz Megahertz Megahertz Number Hertz Specify Degrees F None	TACAN Receiver Freq Spectrum TACAN Receiver Channels TACAN Rcvr Channel Separation TACAN Interrogation Reply Sig TACAN Antennas TACAN Ant. Dsgn Freq Spectrum TACAN Ant. Switching Freq TACAN Ant./Xmsn Line SWR Instrument Approach Equip (ILS) Number ILS Rcvr/Xmtr Channels Localizer Frequency Spectrum Glide Slope Freq Spectrum Localizer Channel Separation Glide Slope Channel Separation Marker Beacon Channels Marker Beacon Frequency ILS Antennas Antennas Design Temp Range Reliability Factor
011003	IFF	Pounds Hertz Hertz Number Watts Watts Percent Microvolts Number Hertz None Hertz Msec Degrees F None	Weight Transmitter Frequency Spectrum Receiver Freq Spectrum Number of Modes Transmitter Power Input Transmitter Power Output Transmitter Efficiency Receiver Sensitivity Number of Antennas Antenna Design Freq Spectrum Antenna/Xmtr Line SWR Antenna Switching Rate Dwell Time Each Antenna Antenna Design Temp Range Reliability Factor
011004	Portable Tape Recorder	Pounds Type Microvolts Hertz None Type Feet	Weight Recorder Recorder Sensitivity Recorder Frequency Spectrum Signal to Noise Ratio Recording Tape Tape Length



WBS CODE	TITLE	UNITS	CHARACTERISTICS
011004	Portable Tape Recorder (Cont)	Minutes Inches/Sec Hertz	Recording Time Recording Speeds Frequency Response
011005	Ground Tests	Type/No. Type/No. Type/No. Type/No. Type % of FS Hertz % of FS Mach No. Degrees F Hertz Watts Days,Hr,Sec	Major Assemblies Models/Mockups Facilities Tests Measurements (Data) Accuracy (Data) Frequency Response (Data) Resolution (Data) Speed Range Temperature Range Frequency Spectrum Power Range Time
0111	Flight Indication System	Pounds Specify Number Number Degrees  Degrees Degrees/Sec Degrees Hertz "G" Mach No. KIAS Degrees F Degrees F Feet Feet/Min None No. of Hr	Weight Major Subsystems Number of Crew Stations Number of Flight Indicators Attitude Error - Pitch, Roll, and Yaw Angular Displacement Signals Angular Rate Signals Alignment Error Frequency Response G Range Indication Speed Indication - Mach Range Speed Indication - KIAS Range Ambient Temperature Range Total Temperature Range Altitude Indication Range Vertical Speed Range Reliability Factor MTBF
011101	Auxiliary Gyro Platform	Pounds Inches Degrees  Degrees	Weight Length, Width, Height Attitude Error - Pitch, Roll, and Yaw Angular Displacement Signals



WBS CODE	TITLE	UNITS	CHARACTERISTICS
011101	Auxiliary Gyro Platform (Cont)	Degrees/Sec Degrees Degrees/Min Degrees None Type/No. Degrees F Degrees Type/No. RPM None No. of Hr	Angular Rate Signals Platform Alignment Error Platform Drift Magnetic Deviation Signal to Noise Ratio Modes of Operation Design Temperature Range Attitude Range Platform Compensation Platform Gyro Speed Reliability Factor MTBF
011102	Flight Instruments	Pounds Type/Nos Degrees Hertz Degrees Degrees Degrees Degrees/Min Degrees Hertz Degrees Degrees Degrees/Min Degrees/Min Hertz Degrees/Min Degrees/Min Degrees/Min Deg/Sec/Min Degrees % of FS % of FS Hertz Degrees F None No. of Hr	Weight Flight Instruments Horizontal Situation Range Horiz Situation Freq Response Horiz Situation Resolution Horizontal Situation Accuracy Horiz Situation Hysteresis Horizontal Situation Drift Attitude Director Range Attitude Dir Freq Response Attitude Director Resolution Attitude Director Accuracy Attitude Director Hysteresis Attitude Director Drift Turn Rate Gyro Range Turn Rate Gyro Freq Response Turn Rate Gyro Resolution Turn Rate Gyro Accuracy Turn Rate Gyro Hysteresis Turn Rate Gyro Drift Standby Gyro Operational Range Standby Gyro Attitude Error Standby Gyro Rate Errors Standby Gyro Response Design Temperature Range Reliability Factor MTBF



WBS CODE	TITLE	UNITS	CHARACTERISTICS
011103	Central Air Data Subsys	Pounds	Weight
		Number	Number of Command Signals
		Number	Number of Subsystem Signals
		% of FS	Pressure Altitude Lag
		Hertz	Pressure Alt Freq Response
		% of FS	Pressure Altitude Hysteresis
		Feet	Pressure Altitude Range
		% of FS	Pressure Altitude Resolution
		M/KIAS	Airspeed Range
		% of FS	Airspeed Resolution
		% of FS	Airspeed Hysteresis
		Hertz	Airspeed Frequency Response
		Degrees F	Total Temperature Range
		% of FS	Total Temperature Lag
		% of FS	Total Temperature Resolution
		"G"	Normal Acceleration Range
		% of FS	Normal Acceleration Resolution
		Hertz	Normal Accel Freq Response
		Feet/Min	Vertical Speed Range
		% of FS	Vertical Speed Resolution
		Hertz	Vertical Speed Freq Response
		Degrees F	Design Temperature Range
		None	Reliability Factor
		No. of Hr	MTBF
011104	Flight Director Computer	Pounds	Weight
		Inches	Length, Width, Height
		Number	Number of Channels
		Number	Number of Input Signals
		Number	Number of Output Signals
		Number	Number of Roll Computations
		Number	Number of Pitch Computations
		Watts	Power Required
		% of FS	Computer Accuracy
		Hertz	Computer Frequency Response
		μsec	Computation Time
		None	Signal to Noise Ratio
		Number	Number of Operational Modes
		None	Reliability Factor
		No. of Hr	MTBF

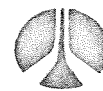


WBS CODE	TITLE	UNITS	CHARACTERISTICS
011105	Ground Tests	Type/No.	Major Assemblies
		Type/No.	Models
		Type/No.	Mockups/Breadboards
		Type/No.	Facilities
		Type/No.	Tests
		Type	Measurements (Data)
		% of FS	Accuracy (Data)
		Hertz	Frequency Response (Data)
		% of FS	Resolution (Data)
		% of FS	Hysteresis (Data)
		Days,Hr,Sec	Time
0112	Test Instrumentation		
011201	Flt Test Instrumentation	Pounds	Total Weight
		Number	Total Number Parameters
		Number	Number of Pressure Transducers
		Number	Number of Thermalcouples
		Number	Number of Strain Gages
		Number	Number of Position Transducers
		Number	No. of Flow Rate Transducers
		Number	No. of Electrical Transducers
		Number	No. of Electronic Transducers
		Number	No. of Accel Transducers
		Degrees F	Temp Envrn Transducer Design
		"G,"Hertz	Vib Envrn Transducer Design
		Hertz	Frequency Response
		% of FS	Accuracy
		% of FS	Resolution
		% of FS	Hysteresis
		% of FS	Linearity
		% of FS	Vibration Error
		% of FS	Temperature Error
		% of FS	Acceleration Error
		Ohms	Elec Transducer Impedance
		Ohms	Elct Transducer Impedance
		Degrees F	Temperature Envrn Wire Design
		"G,"Hertz	Vib Environmental Wire Design
		Counts	Digital Recording Resolution
		% of FS	Digital Recording Accuracy
		Samples/Sec	Digital Sampling Rate
		Samples/Sec	Digitizing Rate
		Hertz	Response Frequency
		Samples/Sec	Commutation Rate Range



WBS CODE	TITLE	UNITS	CHARACTERISTICS
011201	Flt Test Instrumentation (Cont)	Seconds	Time Code
		Minutes	Digital Recording Time
		Words/In.	Digital Tape Density
		Type	Digital Recording Medium
		Bits	Digital Recording Format
		% of FS	Analog Recording Accuracy
		Hertz	Analog Frequency Response
		Seconds	Analog Time Code Period
		Minutes	Analog Recording Time
		Type	Analog Recording Medium
		Number	Analog Data Channels
		IRIG	Analog Bands
		Microvolts	Analog Input Signal
		Ohms	Analog Input Impedance
		% of FS	Analog Frequency Response
		Percent	Analog Harmonic Distortion
		% of FS	Analog Linearity
		% of FS	Analog Stability
		Decibels	Analog Common Mode Rejection
		Amps,Volts	Analog Recording Pwr Req'd
		Number	Telemetered Channels
		Number	Number of TM Radio Lines
		Hertz	TM Frequency Spectrum
		Minutes	VGH Recorder Time
		Type	Cockpit Camera
		Feet/Sec	Landing Gear Camera Speed
		Seconds	Landing Gear Camera Recording Time
		Inches/Sec	Vib & Flutter Recorder Speed
		Hertz	Vib & Flutter Recorder Resp
		Pounds	Instrumentation Package Weight
		Feet <sup>3</sup>	Instrumentation Package Volume
		Inches	Instrumentation Package Length
		Inches	Instrumentation Package Height
		Inches	Instrumentation Package Width
		Feet	Max Inst Package Press. Alt
		Type	Instrumentation Package ECS
		Degrees F	Inst Package Temp Range
		BTU	Inst Package Heat Ejection
		Percent	Reliability Factor Data
		Type/No.	Data Reduction Formats



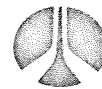


TECHNICAL DESCRIPTION

SUBSYSTEM: \_\_\_\_\_ WBS CODE: \_\_\_\_\_

MAJOR ASSY: \_\_\_\_\_ WBS CODE: \_\_\_\_\_

DESCRIPTION/FUNCTION:



TECHNICAL CHARACTERISTICS PROGRESS SUMMARY

WBS IDENTIFICATION: \_\_\_\_\_ WBS CODE: \_\_\_\_\_

CHARACTERISTIC	UNIT OF MEASURE	MARCH 1959	DECEMBER 1959	FEBRUARY 1961	A/V NO. 1 MAR 1964	A/V NO. 2 MAY 1966

# DEVELOPMENT DATA SUMMARY

WBS TITLE: \_\_\_\_\_ WBS CODE: \_\_\_\_\_

STATE-OF-THE-ART RATING: \_\_\_\_\_

PERCENT DEVELOPED: \_\_\_\_\_ %

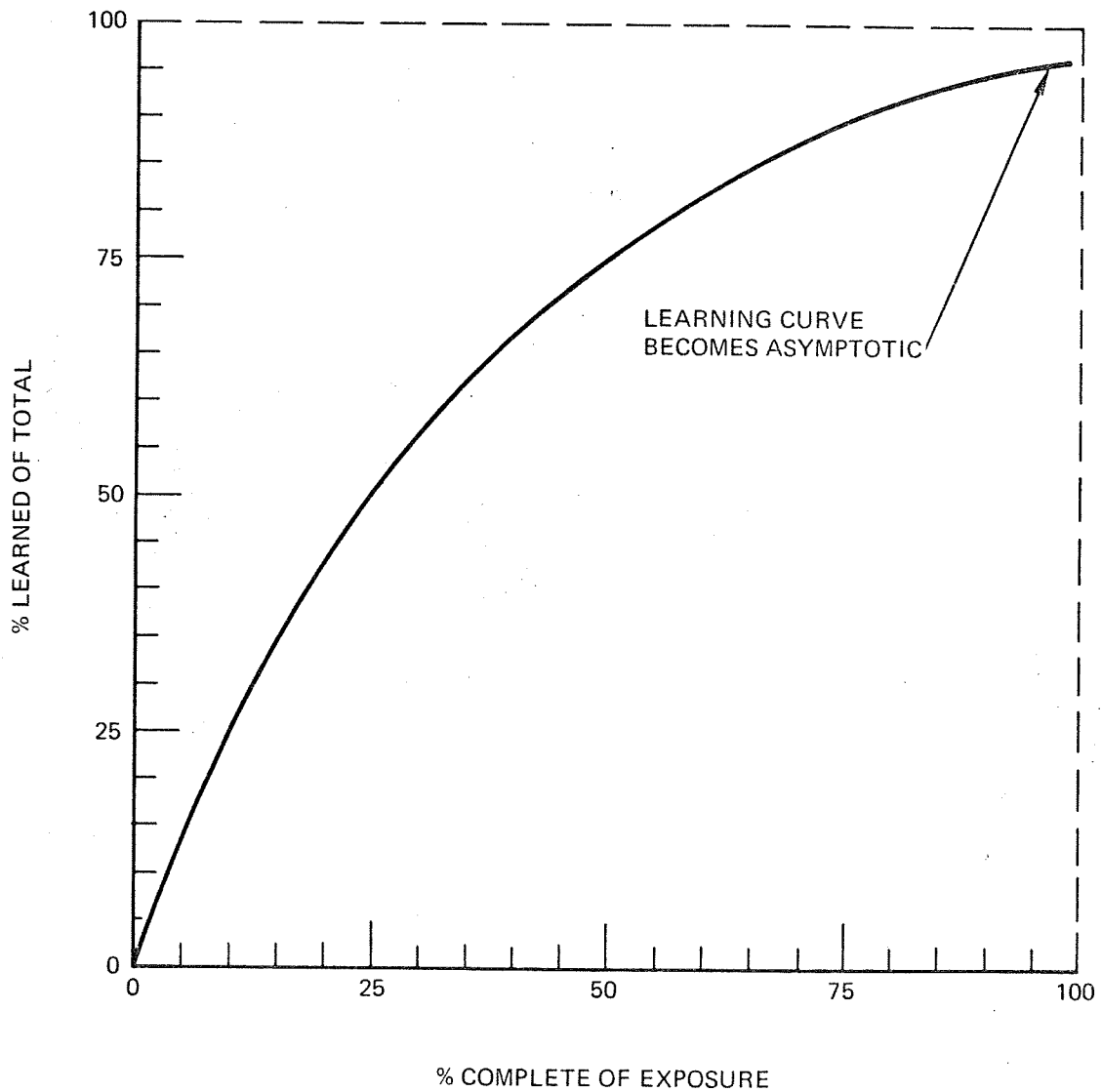
## GROUND TESTS

TYPE OF TEST	NUMBER OF UNITS	TEST HOURS
CONFIGURATION RESEARCH		
DESIGN FEASIBILITY		
DESIGN VERIFICATION		
AIRWORTHINESS		
QUALIFICATION		
OTHER		
TOTAL	_____	_____

REMARKS:



### CLASSIC LEARNING CURVE



EXAMPLE: AFTER 50% OF TOTAL TEST HOURS HAVE BEEN EXPENDED,  
75% OF THE PROBLEMS HAVE BEEN EXPERIENCED.



TECHNICAL DRIVER

WBS TITLE: \_\_\_\_\_ WBS CODE: \_\_\_\_\_

DISCUSSION:

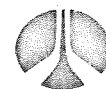


# TECHNICAL DRIVERS LIST

WBS CODE	TITLE	DESCRIPTION
01	AIR VEHICLE	External Configuration Models Stability & Control Models Flexibility & Aerolasticity Models L/D Development Models Shock Field/Acoustics Models Initial Airworthiness; Flt. Tests A/V Performance; Flt. Tests Stability & Control; Flt. Tests AICS/Propulsion Integ.; Flt. Tests
0101	AIRFRAME STRUCTURES	Honeycomb Panels: Design & Fab. Major Assy. Joining Contamination/Corrosion Fuel Tank Sealing Aerodynamic Seals Structural Repair (General)
01010701	GROUND TESTS MODELS	Structural Dynamics Tests Structural Loading Tests
01010703	GROUND TESTS STRUCT. ASSYS.	Structural Integrity Tests
0102	ECS	
01020102	AUX CABIN COOLING	Ram Air Scoop Design
01020103	CABIN VENT & PRESSURIZATION	Cabin Press Control/Regulation
01020104	CABIN HEATING	Heating Distribution
01020105	AIR RECIRCULATION	Instrument Pnl. Cooling
010202	WATER SUPPLY	Contamination
01020302	AMMONIA SUPPLY	Ammonia Leaking & Ingestion
010204	SECONDARY PRESSURIZATION	Seals: Design & Materials
01020801	DRAW CHUTE COMPARTMENT	Insulation/Cooling
01020901	AICS PACKAGE	Cooling Effect Detectors
01021101	GROUND TESTS MODELS	Temp. Survey/Heat Sink Devel.
01021104	GROUND TESTS ECS SIMULATORS	Crew Environment Evals.



WBS CODE	TITLE	DESCRIPTION
0103	PROPULSION	
01030105	ENG. EXHAUST SECT.	Nozzle Leaves
01030107	ENG. ACCESSORY POD	Main Fuel Regulation Accessory Pod Leaks
01030201	ENG. SHROUD AND SEALS	Shroud Development
01030202	AIR GUIDES AND SEALS	Air Guide Fitting/Sealing
010303	ENG. COMPARTMENT COOLING	Controls Development
01030503	FUEL TRANSFER	Pump Mounting/Vibration
01030504	FILTRATION	Contamination/Debris
01030801	ENG. TEST STAND	Main Engine Controls
0104	SECONDARY POWER SYSTEM	
01040101	HYDRAULIC PWR. GENERATION	Pump Design and Development
01040102	HYDRAULIC RESERVOIR SYBSYS.	Hydraulic Fluid Development Contamination/Filter Design
01040103	HYDRAULIC DISTRIBUTION	Line Joining and Closeout Mainfold Design and Fabrication Multi-Port Valves Hi-Freq. Internal Line Stresses
01040201	ACCESSORY GEAR BOX	Case & Lube Sys. Design/Devel.
01040202	POWER TRANSMISSION SHAFT	Flex Coupling Design/Devel.
01040501	ELECTRICAL PWR. GENERATION	Generator Cooling Design/Devel.
01040503	ELECT. PWR. XMSN & DISTR.	Connectors Design & Devel. Wire Insulation Devel.
01040601	ENGINE TEST STAND	Pump Pressure Regulation Lines & Supports Failures Engine Starting Mode
01040602	FLIGHT CONTROL SIMULATOR	Hydraulic Pump Stability
01040603	HYDRAULIC LABS.	Pump Development
01040604	ELECTRICAL LABS.	Connectors/Insulation Devel.
0105	AIR INDUCTION SYSTEM	
010501	INLET SUBSYSTEM	Movable Panel Seals Movable Panel Actuator Seals Panel Bleed
01050202	MAIN DOORS	Door Sealing/Warping
01050203	TRIM DOORS	Door Sealing/Warping
010503	AIR INDUCTION CONTROL	AICS Design and Devel.
01050303	BUZ SENSORS	Detection/Repeatability Devel.
01050307	AUTOMATIC CONTROLLER	Signal Conditioning & Control
01050601	MODELS	External Design & Devel. Internal Compression Boundary Layer Bleed Devel. Control Parameters Devel.



WBS CODE	TITLE	DESCRIPTION
0107	FLIGHT CONTROL SYSTEM	
01070101	CREW STATION CONTROL	Control Column Storage
01070102	ELEVON CONTROL	Actuator Design & Devel.
01070104	CABLE SYSTEM	Tension Regulators "Q" Box-Bellows Sealing
01070203	STAND-BY TRIM ELECTRICS	Trim Motor Design & Devel.
01070207	FLAP ACTUATION	Switch Design
01070211	WING TIP FOLD ACTUATION	Development With H-11 Steel
01070302	FACS COMPUTER	Control Parameters Devel.
01070306	PITCH AUG. SERVO ACTUATOR	Servo Accuracy-Resetting
01070401	FLIGHT CONTROL SIMULATOR	A/V Control: Sensitivity/Resolution
0108	PERSONNEL ACCOM/ESCAPE SYS.	
01080306	ESCAPE REELS	Tension/Braking Rate Devel.
01080402	SEAT EJECTION	Barometer Settings Inertial Reels Hatch Removers Chute Container Lid-Decompression
01080403	CONTROL COLUMN STOWAGE	Thruster Development
010806	DEVELOPMENT TESTS	Capsule Ejection Development
0109	ALIGHTING AND ARRESTING SYS.	
010901	MAIN LANDING GEAR	Hydraulic Line Installation Hydraulic Line Ladder/Swivel Sequence Switches Shock Strut Sealing
01090103	BRAKE SYSTEM	Brake Chatter Speed Sensor Brake Actuators Actuation Valves Development
01090110	MAIN GEAR TIRES	Tire Development
01090202	NOSE GEAR STEERING	Available Power Differential Control
01090302	CHUTE RELEASE MECHANISM	Lock/Rel: Thermal Growth
01090303	DRAG CHUTE	Chute Configuration Devel.
01090503	MISSION HYDROSTATIC TESTS	Energy Absorption/Dissipation
0111	FLIGHT INDICATION SYSTEM	
011101	AUX GYRO PLATFORM	Alignment-Drift
01110304	CADS COMPUTER	Module Reliability





WBS CODE	TITLE	DESCRIPTION
0112	TEST INSTRUMENTATION	
01120101	TRANSDUCERS	Transducer Design/Devel.
01120102	INSTAL. AND ROUTING	Transducer Bonding Wire Design/Devel. Connector Design/Devel.
01120103	AIRBORNE ACQUISITION SYSTEM	Environmental Control Recording Development Reference Techniques
04	FLIGHT TEST PROGRAM	
0441	FLIGHT TEST	
044101	FLIGHT OPERATIONS	Ground Control/Tracking Ground Navigation AIDS Sonic Booms
044105	MAJOR A/V REPAIR	Structure Failures



SECTION V  
PHASE II STATEMENT OF WORK

Task 2.1

Provide summary cost, schedule/milestone and technical data for the WBS items identified by the NASA at the beginning of Phase II. The data presented will be preliminary data submitted to provide timely support to the NASA cost analysis effort. All preliminary data submitted will be subject to refinements prior to inclusion in the Final Report. This initial data submittal is scheduled for late December 1971.

Task 2.2

Provide summary cost, schedule/milestone and technical data for the remaining WBS items not included under Task 2.1. The data presented will be preliminary data submitted to provide timely support to the NASA cost analysis effort. All preliminary data submitted will be subject to refinements prior to inclusion in the Final Report. This data submittal is scheduled for late March 1972.

Task 2.3

Accumulate, refine and prepare cost, schedule/milestone and technical data required to produce the Contract End Items to be submitted in mid-April 1972. All study cost data will be classified as Company Proprietary. Contract End Items are:

1. Final Report containing the cost, schedule/milestone and technical data provided in accordance with the Phase II Study Plan. The volumes of this Final Report will conform to the specifications outlined in 4.1.4.5 of the Contract Statement of Work. Fifteen (15) hard copies of the Final Report will be submitted. Microfiche of this report will be provided.
2. Fifteen (15) copies of a summary document of not more than 15 pages containing all pertinent program elements is identified by the contractor.
3. Hard copy of computer output of the study cost data in several contractor selected formats. The computer program to provide these outputs is not a deliverable item under the terms of this contract.
4. Magnetic tape of the study cost data to the NASA fixed record length format structured to the same specification utilized to produce the magnetic tape for the Apollo CSM Study.
5. Final briefing on the contents of the Final Report.